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THE EFFECT OF ARRANGEMENT ON THE USE OF LIBRARY CATALOGS--AN EXPERIMENTAL STUDY OF A DIVIDED AND A DICTIONARY CATALOG.
FINAL REPORT.
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DESCRIPTORS- *CATLOGS, *LIBRARIES, *COMPARATIVE ANALYSIS, LIBRARY SCIENCE, INFORMATION STORAGE, *DICTIONARY CATALOGS, *DIVIDED CATALOGS,

THE PURPOSE OF THE STUDY WAS TO DETERMINE IF DIVIDING A TRADITIONAL DICTIONARY CATALOG TO CREATE A SEPARATE FILE FOR SUBJECT ENTRIES WOULD RESULT IN MORE EFFECTIVE USE OF LIBRARY CATALOGS. A SET OF SEARCH QUESTIONS WAS DEVELOPED AS THE DATA COLLECTION INSTRUMENT. TWO CATALOGS--THE UNIVERSITY OF ILLINOIS' DICTIONARY CATALOG AND THE UNIVERSITY OF WISCONSIN'S CATALOG DIVIDED INTO SUBJECT AND NON-SUBJECT ENTRIES--WERE SELECTED AND THE APPROPRIATE SECTIONS VERIFIED AS TO SIMILARITY OF SIZE AND COMPLEXITY. PARTICIPANTS WERE UNDERGRADUATE STUDENTS RANDOMLY SELECTED AT THE TWO UNIVERSITIES. EFFECTIVE USE OF THE CATALOG WAS MEASURED BY A MEAN SUCCESS SCORE REPRESENTING THE ABILITY OF PARTICIPANTS TO SELECT APPROPRIATE SUBJECT REFERENCES IN RESPONSE TO QUESTIONS. IT IS CONCLUDED THAT FOR A SERIES OF QUESTIONS REPRESENTING DIFFERENT LEVELS OF DIFFICULTY AND FOR A FARILY LIMITED RANGE OF CATALOG USE HABITS AND ABILITY, CHANGE IN THE ARRANGEMENT OF LARGE CATALOGS WOULD NOT RESULT IN MORE EFFECTIVE USE. THERE IS ALSO NO EVIDENCE TO INDICATE THAT ONE TYPE OF CATALOG IS SUPERIOR TO THE OTHER. THIS DOCUMENT WAS SUBMITTED AS A PH.D. THESIS UNDER THE TITLE "THE EFFECT OF ARRANGEMENT ON THE SUCCESSFUL USE OF LIBRARY CATALOGS" TO THE GRADUATE COLLEGE OF THE UNIVERSITY OF ILLINOIS. (AUTHOR/CC)

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October 1967

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James Krikelas

October 1967

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University of Illinois

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CHAPTER I

BACKGROUND AND DEVELOPMENT OF THE PROBLEM

The library catalog, acknowledged as an indispensable index to the library's collection, has been subjected to severe criticism. To the library administrator, the catalog represents the end product of extensive utilization of library funds, time and personnel. It is, therefore, understandable that much concern has been expressed regarding the efficient preparation and maintenance of the library's collection.

In response to this concern there have been numerous catalog cost as well as time and motion studies which have attempted to determine how much of the library's efforts are used in such preparation.[1] While many of these studies have dealt with the problems of the more traditional card catalog, recent efforts have also been concerned with the economics of preparing and maintaining computer-produced catalogs. Although such endeavors are desirable, the decision as to format, content, depth of analysis, etc., must still be based upon an understanding of the functions of the catalog and an evaluation of its success in achieving them.

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[1] For a recent summary of such studies see Donald Duane Hendricks, "Comparative Costs of Book Processing in a Processing Center and in Five Individual Libraries." (Unpublished Ph.D. dissertation, University of Illinois, 1966), pp. 23-35.

Faced with the choice between two methods of catalog preparation and maintenance, the judgment as to efficiency (a cost factor) can legitimately be made in regard to systems of equal effectiveness (a function factor). This basic problem was aptly stated by Reichmann when he reasoned that "no evaluation of operational costs is realistic and meaningful unless the final product is taken into account."[2]

The indexing of library holdings has undergone many changes throughout the history of libraries. The catalog has appeared in printed sheets, printed books and on cards. The card catalog was introduced in the United States during the mid-nineteenth century and "two or three decades more were to elapse before it was generally accepted."[3] Since that time it has become the dominant form and exists today in arrangements known as dictionary, divided or classified.

The term "dictionary" is misleading in some respects but it has come to mean, traditionally, a catalog that arranges all types of entries into an alphabetical sequence--with certain chronological and arbitrary exceptions (such as the rules for filing subordinate agencies, books of the Bible, an author's collected works before or after single works, etc.). The physical separation of the various components of the dictionary catalog into separate indexes is known as a divided catalog. The most frequent separation is the two-sectioned catalog composed of an author-title sequence and a subject sequence; other combinations are possible and do exist. The third type, the classified catalog, "is necessarily limited to subjects, and in it the entries are arranged according to some preconceived scheme in which related subjects are brought together or associated with the other."[4]

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[2] Felix Reichmann, "Costs of Cataloging," Library Trends, 2 (October 1953), 313.

[3] James Ranz, "The History of the Printed Book Catalogue in the United States." (Unpublished Ph.D. dissertation, University of Illinois, 1960), p. 1.

Dividing the Catalog as a Method for Improving Use

With the exception of Fletcher's article in 1905,[5] the merits of the divided catalog have been the subject of discussion by librarians only since 1935. While no definite advantage has been established for the divided catalog in the studies made to date "it would seem that what evidence is available supports division for almost any catalog of any size."[6] Two general reasons consistently appear for deciding to divide the dictionary catalog. These are, in general, (1) the problem of congestion and/or spatial limitations, and (2) the complexity or illogical nature of the dictionary catalog.

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[4] Jesse H. Shera and Margaret E. Egan, The Classified Catalog: Basic Principles and Practices (Chicago: American Library Association, 1956), p. 13.

[5] William I. Fletcher, "The Future of the Catalog," Library Journal, 30 (March 1905), 141-44.

[6] Maurice F. Tauber, "Cataloging and Classification," in Ralph R. Shaw, ed., The State of the Library Art, Vol. I, Part 1 (New Brunswick, N.J.: Graduate School of Library Service, Rutgers - The State University, 1960), pp. 92-101.

Some librarians have stated that division will alleviate congestion at the catalog and represents a natural partitioning when spatial limitations require parts of the catalog to be physically separated.[7] While division may truly be logical when space requires that new cases be located some distance from the existing catalog this can be considered a temporary solution at best. When further expansion becomes necessary these libraries will be faced with the compounded problem of having two separate alphabetical sequences to relocate. Further, the charge that congestion is more acute with the dictionary catalog than with the divided catalog appears invalid. Lubetzky has appropriately pointed out that "given a number of catalog users, congestion is a function of the number of drawers and feet of space available" and "congestion will remain unchanged regardless of the arrangement and grouping of the drawers in one or several catalogs."[8] Therefore, while the problems of congestion or spatial limitation may serve as the impetus to consideration of dividing the dictionary catalog, these factors alone cannot justify the decision to divide.

In 1905, William I. Fletcher posed the question of the capability of the dictionary catalog to cope with the problems of the increasing size of library collections and the resulting complexity of their catalogs. He then described the value of the separate subject catalog at Amherst College with its special reference to printed subject bibliographies.[9] For 30 years his question remained unanswered. The discussion was reopened in 1935 when Donald Coney raised a similar warning when he asked "Is the alphabetical catalog best arranged in one alphabetical sequence?" The question was raised not "for its academic value, but by a quest for the solution to the problem of simplifying, for lay use, the standard dictionary form of catalog." He was convinced "that the catalog confuses the user with a wealth of detail in unfamiliar form."[10] This opinion was supported in a study by Margaret C. Brown in which graduate students using the subject catalog were observed. One particular student was seeking information on the subject "rural recreation."

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[7] For a general discussion of the literature and the problems see Fred Heinritz, "Does Dividing the Catalog Relieve Congestion?" Library Resources and Technical Services, 8 (Summer 1964), 310-16.

[8] Seymour Lubetzky, "Crisis in the Catalog," Catalogers' and Classifiers' Yearbook Number Eight (Chicago: American Library Association, 1940), p. 49.

> Next the student went in search of any subject which began with the word "rural." Here several titles relative to the subject were found. The student was highly pleased with this development but quite unaware that these were title entries.[11]

The divided catalog has been turned to as an answer to making the library catalog more usable. Certainly extensive research is needed to determine what the patron looks for in a catalog. This research may produce necessary changes in the rules of descriptive cataloging, in the principles of subject headings, or simplification of present filing codes. These shortcomings, however, are not automatically corrected by dividing the catalog.

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[9] Fletcher, op. cit.

[10] Donald Coney, "The Librarian and the Catalog," ALA Bulletin, 29 (September 1935), 593-94.

[11] Margaret C. Brown, "The Graduate Student's Use of the Subject Catalog," College and Research Libraries, 8 (July 1947), 203-08.

A summary of the literature on the divided catalog has been compiled, at various times, by Pettee,[12] Grosser,[13] Tauber,[14] and more recently by Hines and Harris.[15] In reviewing the literature it becomes evident that the published reports, studies and articles on the divided catalog fall into one of three general categories: (1) opinions of librarians and patrons who have had experience with a divided catalog; (2) studies on the use of the catalog; and (3) general evaluations of the divided catalog with uncommitted points of view. Of the studies into the use of the catalog, none attempted to establish a causal relationship between the type of arrangement and the successful location of subject materials by the patron. Tauber, in fact, was led to remark that the evidence from such research was inconclusive and that "the presence of guess-work and rationalization . . . suggests that further study of the arrangement of the catalog is desirable."[16]

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[12] Julia Pettee, Subject Headings (New York: H. W. Wilson Co., 1947), pp. 185-86.

[13] Dorothy Grosser, "The Divided Catalog: A Summary of the Literature," Library Resources and Technical Services, 2 (Autumn 1958), 238-52.

[14] Tauber, op. cit., pp. 92-101.

[15] Theodore C. Hines and Jessica L. Harris, Computer Filing of Index, Bibliographic and Catalog Entries (Newark, N.J.: Bro-Dart Foundation, 1966), pp. 105-06.

The problem, therefore, is to determine if the division of the catalog actually does result in a difference in the user's ability to consult the catalog. The hypothesis to be tested may be stated as follows:

> Assuming all other factors are equal, subject searches through a file containing subject entries alone will produce more pertinent references and less inappropriate references than identical searches using a file combining all entries into a single (dictionary) sequence.

That is to say, it is believed that catalog users do not completely understand present devices for indicating conceptual differences (i.e., the same term or terms used to indicate both subjects and non-subjects) such as capitalization of subject entries or the use of red type. Hence, those changes introduced to make such differences more explicit should increase the effective use of the library catalog. If this is true, then the subject entries in a dictionary arrangement that are not in conflict with similar or identical non-subject entries should be retrieved as successfully as if they were contained in a separate file of subject entries.

Measuring Effective Use

Measuring the effective use, let alone improved use, of the library catalog presents some problems. Lilley, in an excellent discussion of the measurement of catalog use, remarked that such measurement could only be made in terms of the function of the catalog.

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[16] Tauber, *op. cit.*, p. 98.

> . . . as soon as the function of the catalog has been determined, and generally agreed to by the profession, we can use the statement of function as a standard of judgment that will let us derive estimations of value from measurements of use. . . . at the moment we have no clear-cut understanding of the catalog's true function.[17]

There exists a fairly extensive body of literature which is centered around the discussion of the problem of constructing a card catalog solely as a "finding list" as opposed to the catalog as a comprehensive "bibliographical tool." As long as this argument is centered around this either/or dichotomy, it is difficult to arrive at any solution. The problem is not a matter of kind but, rather, of degree.

Consider the patron who poses the question "Does the library contain such-and-such a document?" In order to search the catalog, the request must be made in terms of some convenient descriptive tag. This tag may be an author, or title, or some other information which the user assumes to be in the catalog. The cataloger, on the other hand, is faced with the problem of having a document in hand and wishing to indicate that it is now a part of the local collection. To do so, he must describe it and does so by selecting one or more descriptive tags. These too may be the author's name, or the title of the document, or some other information which is deemed important enough to distinguish one document from another.

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[17] Oliver Linton Lilley, "The Problems of Measuring Catalog Use," Journal of Cataloging and Classification, 10 (July 1954), 127.

The number and completeness of the tags selected by the cataloger are based upon two factors. First, the cataloger realizes that the document is ordinarily physically accessible and can limit his description to a greater degree than can the bibliographer who must assemble together items that may not be accessible at one single place or may not actually exist (i.e., an "ideal copy"). In reality this procedure does not assign any function to the catalog that is not traditionally expected. Writing about what is probably the largest card catalog in this country, Dubester said of the Library of Congress catalog:

> The present catalog in its dictionary form provides for the exercise of certain very specific functions. It serves primarily to determine whether a known and identifiable work is in the collection. Further, and as a very specific result of the ALA rules for author and title entry and our pattern of subject analysis, we are able to answer the following: give me all the works of such-and-such an author; give me all editions of forms of such-and-such a work; and what do you have on such-and-such a subject and on related subjects.[18]

This is, essentially, a synthesis of the separate functions of the author-title catalog as expressed at the 1961 "Conference on Cataloguing Principles"[19] and the function of the subject catalog as outlined by Coates.[20]

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[18] Henry J. Dubester, "Studies Related to Catalog Problems," Library Quarterly, 34 (January 1964), 100.

The second factor, which the cataloger must recognize, is the amount of information the patron is likely to possess. This problem quite naturally leads to the suggestion that, in order to make such a judgment, one must know something about who uses the catalog and for what purpose. In response to this question, numerous catalog use studies have been undertaken.

One of the earliest advocates of a systematic, experimental approach to the study of catalog use, William M. Randall, prepared the theoretical framework within which most of the subsequent studies were undertaken:

> The problem, then, is to fit our catalogs to the patrons we serve. This cannot be done by any study of the catalogs themselves, or of the rules by which they are made; neither can it be done merely by an examination of the books to be cataloged. It can be done only by an intelligent study of the patrons themselves; their mental equipment, their background, and their needs.[21]

There are over 40 catalog use studies which have been reported in the literature of librarianship and which represent a wide variety of catalogs and patrons subjected to study and evaluation. Most of this literature has been ably summarized by such writers as Stevens,[22] Tauber,[23] and Frarey.[24] These post-1930 studies have indicated a wide variation in users, their ability, their concepts of the proper role of the catalog in the complete bibliographic system, and differences in the patrons' background (such as formal instruction in the use of libraries and catalogs, the amount of experience, the influence of previous "successful" uses, etc.). Many of the studies have also included a discussion on the effectiveness of the catalog. The method of measuring effectiveness has essentially been that of determining how frequently the patron is satisfied in his search for some material. According to this measure, Frarey is able to report a median of 70 percent based on studies which report successes that range from 50 to 95 percent.[25] In a more recent study, Morris reports that the effectiveness of one college library catalog--in terms of subject searches--was

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[19] International Federation of Library Associations. International Conference on Cataloguing Principles, Paris, 9th-18th, October, 1961. Report (London, Organizing Committee of the International Conference on Cataloguing Principles, 1963), pp. 91-92.

[20] E. J. Coates, Subject Catalogues: Headings and Structure (London, Library Association, 1960), p. 19.

[21] William M. Randall, "The Uses of Library Catalogs: A Research Project," Catalogers' and Classifiers' Yearbook Number Two (1930) (Chicago: American Library Association, 1931), pp. 31-32.

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[22] Rolland E. Stevens, *A Summary of the Literature on the Use Made by the Research Worker of the University Library Catalog*. (University of Illinois Library School, "Occasional Papers" no. 13, Urbana, 1950).

[23] Tauber, *op. cit.*, pp. 65-101.

[24] Carlyle J. Frarey, "Studies of Use of the Subject Catalog: Summary and Evaluation," *in* Maurice F. Tauber, ed., *The Subject Analysis of Library Materials* (New York: School of Library Service, Columbia University, 1953), pp. 147-66.

[25] Carlyle J. Frarey, "Subject Headings," *in* Shaw, *op. cit.*, Vol. 1, Part 2, pp. 49-50.

96 percent.[26] As a result of these studies and their findings many of the investigators have recommended that there is a great need for "more and better instruction in catalog use among all classes of patrons."[27]

The basic difficulty with attempting to apply this recommendation is that there is no conclusive evidence that would help to establish the appropriate level of knowledge and familiarity that such instruction must attempt to reach. Not even the professional library education program would seem to guarantee adequate preparation if there is general applicability to Jackson's observation that "not all staff members were more skilled than the patron at using the catalog."[28]

While the general findings of the numerous catalog use studies have been subjected to criticism and found wanting, there has seldom been an effort to determine why these studies should produce such inconclusive data when discussing the effective use of the catalog. The very assumption that the methods employed to conduct these studies have been appropriate and adequately designed is subject to question. Two of the more perceptive critics of catalog evaluation studies--Mortimer Taube and Oliver L. Lilley--have, indeed, cast doubt about the methods used in conducting such studies and have proposed alternate approaches. Lilley's proposal is principally one of comparing existing subject catalogs against an ideal catalog:

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[26] Mary Eugenia Morris, "A Study of the Use of the Card Catalog at Western Carolina College Library." (Unpublished Master's thesis, School of Library Science, University of North Carolina, 1966), p. 39.

[27] Frarey, "Studies," p. 163.

[28] Sidney L. Jackson, Catalog Use Study: Director's Report, ed. by Vaclav Mostecky (Chicago: American Library Association, 1958), p. 2.

> _If_ we had an ideal subject catalog, or what would _be_ just as good, an exact and complete description of an ideal subject catalog, then we could compare the actual instrument with the model, detail by detail, and develop a precise statement of their differences. . . .
>
> The crux of our problem then is to find a way to give concrete expression to something the library profession as a whole might accept as the "ideal" toward which the subject catalog should be expected to approach.[29]

Lilley then continued by outlining a five-point program that would attempt to achieve this ideal. He conceded that his plan was one step further removed from direct evaluation of the catalog but he felt it would be "achieving the same goal of improvement through a more basic study of appropriate and desirable functions, and of fundamental philosophy."[30]

Taube, in his criticism of general attempts to evaluate "information systems," has pointed out the interrelationship between the design and characteristics of the system itself and the satisfaction of the user, naming these internal and external criteria.[31] Although realizing the importance of using both criteria for evaluation, Taube concluded that at that time such evaluation could not be accomplished. Instead, he proposed that fifteen characteristics, which he identified as implicit evaluative criteria in previous studies, could be enumerated and that these fifteen might be agreed upon "as criteria or measures of consumer satisfaction."[32] Thus, Taube felt, an evaluation of the internal criteria was a valid procedure since it accounted, by agreement, for the criterion of user satisfaction.

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[29] Oliver L. Lilley, "Evaluation of the Subject Catalog; Criticisms and a Proposal," _American Documentation_, 5 (April 1954), 47.

[30] _Ibid_., 49.

[31] Mortimer Taube, "Evaluation of Information Systems for Report Utilization," _in_ his _Studies in Coordinate Indexing_, _I_ (n.p., Documentation, Inc., 1953), p. 96.

The proposals of Lilley and Taube are not really very different; both attempt to establish a standard of some type against which comparison might be made. The basic difference seems to be in the method of achieving this standard rather than in the method of evaluation. Both proposals, however, suffer a critical shortcoming as a method for evaluating catalogs--or any other type of index. The two are dependent, as noted, upon an ideal or basic standard. (Absence of such agreement, of course, makes the approach impossible.) Assuming that such agreement can be reached, the index system must then be tested to determine if the underlying assumption--that internal criteria (or professional judgments) are, indeed, an accurate measure of consumer satisfaction--is valid, and this requires a user-oriented approach. Neither proposal seems to suggest any marked improvement over the methods of previous catalog use studies.

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[32] _Ibid_., p. 101.

The Experimental Approach to Measuring Effective Use

A criticism of previous studies must begin with an examination of the principle which served as a directive for the studies. A review of the most significant studies indicates that there is either a direct or indirect connection with Randall's thesis as presented in his 1930 address. As a method of finding out who uses the catalog and for what purpose, his proposal is quite feasible. When it is made to serve as the focus for determining how well individuals use the catalog, what problems they encounter, and what improvements will erase these problems, the traditional catalog use studies are completely inappropriate. Whether intentionally or not, Randall's thesis has been paraphrased in these studies to read:

> Give us an idea of the nature of the typical user and we can construct a catalog which anyone should be able to use.

The most obvious problem in this method of evaluating the effectiveness of the catalog is that of developing an acceptable definition of a typical user. Such a user may be, at least by definition, one who has little trouble in using the catalog, or one who has little success, or some arbitrary standard between these two levels of performance. Unfortunately, if one must also consider the possible ranges in age, education, occupation, and other factors, the meaningfulness of the term "typical" ceases to exist. That this is obvious today is primarily due to the results of the studies being criticized, and is sufficient justification for having done them. At the same time, they illustrate the futility of continuing this approach as a method for evaluating the catalog.

A second, and more critical, shortcoming of the previous studies has been their failure to recognize the very interaction that Taube mentions. Most studies have attempted to generalize a situation that includes a varying patron (and his inevitable individual differences), a varying catalog and a wide range of questions posed by the user. The measure of effectiveness, therefore, is actually that of a patron-catalog-question system and should not be attributed to any single element--the catalog--unless certain factors are controlled. For example, the searches utilized to test catalog users were generated by the patron rather than the investigator in most instances. Since there is no existing evidence that these represented all types of problems that may be encountered, the calculated level of effective use is applicable only to specific sections consulted and may not be generalizable to the catalog as a whole.

Furthermore, there is the matter of the catalog itself. The assumption that the catalog variable has been held constant in each of the studies is open to question. The complexity of any given section of the catalog will vary in relation to the particular part (and size) of the collection represented, the complexity of the filing rules applicable to that section, and the possibility that the term selected to be searched may appear in a number of variant forms (i.e., main, subject added, or non-subject added entries). If various parts of the catalog are more difficult to use than others (e.g., the "U.S." drawers), then the differences in successful use may only reflect the accidental occurrence of selecting patrons using different parts of the catalog. Thus, depending on the search, patrons may have been using a fairly simple bibliographic tool or an exceptionally complex one, even though it was one and the same catalog.

Hence, a more fruitful approach would be to restate the user-oriented method of study in rather different terms. The general thesis then becomes:

> If we have a known level of effective use for a given patron and a given type of library catalog, what changes in bibliographic entry, formatting, increases in cross-references, etc., will yield a significant increase in the patron's effectiveness level?

Such an approach combines the advantage of testing directly the user's satisfaction (and ability), provides evidence of the effect of the interplay between internal criteria (the catalog) and external criteria (both the user and the problem-question) and is a comparison between a basic standard (the known level of effective use) and the level of effectiveness using a modified catalog. Rather than establishing an "ideal" catalog, however, it is possible to take any existing catalog, determine how well the patron is able to use it, and then have the patron replicate the searches using the catalog after it has been changed.

It would seem that this method is applicable to almost any type of comparison, given the necessary controls over all variables in the system. At the present time no single study can adequately cope with all the possible combinations that reflect alternate forms of the various internal and external criteria. There is a need for a complete series of studies in which each element is introduced as an experimental variable and the influence on effective use measured. It is within this framework that the design for testing the hypothesis concerning the improvement of catalog use by division was developed.

Summary

The merits of the divided catalog versus the dictionary catalog have been discussed in the literature of librarianship for over 30 years. A review of this literature revealed that the evidence in support of either type of arrangement is inconclusive. The purpose of this study was to investigate the comparative effectiveness of a divided catalog and a dictionary catalog in facilitating subject searches. The problem of measuring effective use, and certain methodological shortcomings of previous research, led to the development of the comparative method of study. An experimental approach was outlined in which a patron (a constant) would make the same search (also a constant) using, first, a catalog in dictionary arrangement and then the same catalog divided into author-title and subject sequences. Chapter II is a discussion of the problems, limitations, and design of a practical study developed within this theoretical framework.

CHAPTER II

DESIGN AND PROCEDURE

The purpose of this study was to determine if dividing a traditional dictionary catalog to create a separate file for subject entries would result in an increase in the effective use of library catalogs. A comparative method for making such an evaluation was developed in Chapter I. The purpose of this chapter is to describe the influence of practical limitations on the final design of the study. Control of the variables that must be considered in an experimental approach to testing the hypothesis are discussed. In addition, the effects of various underlying assumptions and the desired analysis to be made are considered in relation to the design and procedure.

Design of the Experimental Approach

The causal element.--Difficulty in the use of the catalog may be due to a number of reasons. Occasionally patrons expect to locate material that is not traditionally indexed by the library catalog. Incorrect bibliographical information may also be the cause for failure in locating appropriate material. Frequently, failure can be attributed to the patron's inability to formulate the correct search strategy by not selecting the appropriate term or synonym. In other cases the term selected is not of the appropriate level of specificity to isolate the necessary references. This problem of selecting the appropriate search term has been emphasized in such studies as those conducted by Malcolm[1] and Lilley.[2] Dividing the catalog into two or more separate files will not, of course, alleviate all these difficulties. Division, in fact, would seem to result only in making the subject approach more explicit and in reducing the confusion between subject and non-subject entries. That confusion is a source of failure can be indicated by considering the types of cards to be found in a card catalog.

The catalog is composed of three basic types of cards: main entries, added entries, and references.[3] Subject headings are primarily added entries and reference ("see" and "see also") entries. By the nature of the various rules of cataloging, similarities between the subject of a book and the title of that book are suppressed in favor of subject added entries. The possible occurrence of misunderstanding between a subject added entry and a title added entry is, therefore, reduced. Other subject headings, however, are of a form that is identical to main or non-subject added entries. Hence, reference to material by or about an individual, society, institution or governmental agency will be shown by using the same terms for the heading whether they are main or secondary entries. To emphasize the difference between these identical headings being used to signify different concepts, two general devices are used. One device is to vary the typographical presentation, resulting, in most cases, in the indication of subject added entries in capitals or red type. (A variation of this approach is the one found in printed indexes where the subject is indicated by some heading--frequently printed in italics--while other types of added entries are suppressed in favor of a cross reference to the main entry.) The second device is to treat each heading and its corresponding conceptual representation as a separate file. In the dictionary catalog this results in the filing of subjects after the main and added entries, in the divided catalog it results in the establishment of a physically separate file.

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[1] Roberta Suits Malcolm, "The Student's Approach to the Card Catalog: A Study Based on a Survey of Student Use at the Library of the University of Pittsburgh . . ." (Unpublished Master's thesis, Carnegie Library School, Carnegie Institute of Technology, 1950), p. 9.

[2] Oliver L. Lilley, "Evaluation of the Subject Catalog; Criticisms and a Proposal," American Documentation, 5 (April 1954), 41-42, 51-60.

[3] The definitions of the terms are those established at the International Conference on Cataloguing Principles. See International Federation of Library Associations. International Conference on Cataloguing Principles, Paris, 9th-18th October, 1961. Report. (London, 1963), p. 115.

Some evidence and much testimony would indicate that these devices are often too subtle for the lay user of the catalog to recognize unless the device is made more explicit as in the case of the divided catalog. Considering the number of possible conflicts, this becomes a serious problem in large or highly specialized catalogs. The fact that the divided catalog does, at least in theory, tend to make the subject references more explicit is the reason (i.e., the causal element) for predicting that the divided catalog would be more effective to use than a dictionary catalog. If the same person makes identical subject searches in two catalogs--one divided and one in dictionary arrangement--it can be assumed that the difficulties the patron would have would be common to both catalogs except for one area; in the divided catalog, title and other conflicting entries could not be confused with appropriate subject entries.

The search-problem as a variable.--The traditional method for securing data on catalog use has been to observe patrons at the catalog and to note what the person was looking for. Some expression or judgment that the patron found what was needed was deemed the criterion for success or failure, indicating that the catalog was or was not an effective bibliographical tool. This measure of effectiveness assumes that a given patron who may successfully use the catalog in searching for one item will not fail completely on the next search even though subsequent searches may require coping with different degrees of complexity. Under such circumstances it is questionable to attribute success or failure to the catalog alone rather than to a variety of factors.

To give meaning to any statement that one catalog is "better" or "easier" or more "effective" to use, it is necessary that the comparison be made across a broad spectrum of representative problems or at least about identical types of searches. Having patrons search the catalog for a request presented by the investigator would achieve the desired control. In order to test the basic assumption that difficulties actually do vary according to the type of question--and the complexity of the catalog encountered--the development of a series of problems is necessary.

First, the selected search-problems should include a number of entries that represent different concepts (that is, identical headings representing main, non-subject and subject added entries) as a means for testing the original hypothesis. Furthermore, to determine if this confusion of concepts is the actual source of difficulty, and not representative of difficulty in dealing with subject searches in general, additional search-problems should be included that represent searches under the more traditional form of subject heading. The variety of forms, as identified by Haykin[4] and more precisely categorized by Eaton,[5] would be more than could be included within a reasonable problem-solving exercise and will have to be limited.

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[4] David Judson Haykin, Subject Headings: A Practical Guide (Washington, D.C.: U.S. Government Printing Office, 1951), pp. 21-25.

[5] Thelma Eaton, Cataloging and Classification: An Introductory Manual (3rd ed., Champaign, Ill.: Distributed by the Illini Union Bookstore, 1963), p. 131.

Finally, dividing the catalog to increase effectiveness in making subject searches should not result in a corresponding decrease in the ability of patrons to locate known-items (for which an author, title, editor, etc., is known). To test this assumption that division does not decrease the effective use of the catalog to search for a known-item, a few problems for which the author and title are given should be included.

The catalog variable.--Ideally, an evaluation of any type of catalog with any type of user-universe can be undertaken. The procedure, in simplest terms, would be to have patrons conduct a series of controlled searches using a specific catalog, to make whatever change in the catalog is deemed important for producing an improved catalog, and then to have the patrons replicate the searches. A comparison of the successes between the two catalogs would isolate the influence of catalog manipulation on the effective use of the catalog. This procedure, however, has certain weaknesses because there is no control over the maturity of the user (the measures are on individuals whose previous exposure to the two catalogs varies) and it creates the difficult problem of developing two sets of questions identical enough to measure the same searches but sufficiently different to reduce the effects of memory.

A more practical limitation is that such a study would result in certain hardships in the actual operation of any given library--both in terms of cost to the institution and in the inconvenience to the general patron. If it is impractical to utilize an existing catalog to make temporary changes in arrangement to use the "before-after" technique of comparison, it should be possible to find two catalogs that are relatively similar in all respects except arrangement. Furthermore, since the type and number of searches to be made are to be controlled by the investigator, it is possible to limit, or at least to estimate, what sections of the catalog will be used, making it necessary to match only sections rather than the whole of the catalogs.

The patron as a variable.--The introduction of two catalogs at separate institutions, on the other hand, poses a problem in maintaining control over the participant--since the hypothesis is stated in terms of one person's success (or failure) in using the catalog. One approach to this problem is to attempt to match individuals at the two institutions and to treat the results as those of one person, the difference being attributed to the experimental variable--the difference in arrangement of similar catalogs. Matching individuals presents obvious difficulties, but as Selltiz points out:

> The more precise the matching and the greater the number of factors on which matching is to take place, the greater the number of cases for which no match is available. Fortunately, however, relevant factors are often so interrelated that matching on one factor brings with it partial matching on other factors; there is a "diminishing return" as additional factors are controlled.[6]

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[6] Claire Selltiz et al., Research Methods in Social Relations (Rev. one-vol. ed.; New York: Holt, Rinehart and Winston, 1959), p. 105.

The limitations of previous catalog use studies are no more evident than when faced with the problem of predicting what factors are interrelated and what would be the appropriate one or two variables to use to match individuals. One important factor is that the two user-universes must be as similar as possible. In addition, it is assumed that facility in using the catalog is related to experience and familiarity in using any single catalog. For the selected user-universe of undergraduate students, it was determined that this factor of his familiarity-experience could be measured by obtaining information about the student's class standing and the frequency of use of the main catalog. The validity of this assumption could be tested by analysis of the resulting test scores against other personal and educational characteristics after the collection of the data.

Scoring the results.--The scoring of the searches was determined by the objective of the study. Previously, tests of effective use have been based on some degree of satisfaction on the part of the user that what he has located is relevant to his need. This concept of relevancy poses more difficulties. While it is fairly simple to determine whether or not someone has located a known-item, it is more difficult to make a judgment as to the appropriateness of a reference when the subject approach has been used. Furthermore, what may be a relevant document for one individual may be irrelevant for a second, even though they both may have selected the same index term to make the search. Therefore, it was intended that this study would deal with the patron's ability to search the catalog for appropriate cards rather than for specific documents.

The judgment as to relevancy is fairly objective since the reference is defined as relevant only if it contains the exact subject heading requested. The patron will then indicate all, none, or some, pertinent references, and none or some non-pertinent references. In order to make the results comparable it was proposed to compute a "success ratio" for each search and to compute a mean success score for each individual. The success ratio (S) was computed by using the following formula:

let r = the number of relevant references retrieved by the participant;
k = the total number of known relevant references in the file;
t = the total number of references retrieved by the participant;

then: $S = (r/k) \times (r/t) = r^2/kt$.

In addition, when the number of relevant references retrieved (r) is zero, the success ratio, by definition, was scored as zero. A hypothetical example may be used to demonstrate the scores that can result from various procedures.

Consider a file of cards which contains ten main entries, ten non-subject added entries and ten subject added entries for a heading such as "U.S. Library of Congress." The number of relevant references about (rather than by) the Library of

Congress would be ten (k = 10). The patron who selects all ten cards would receive a score of:

$$S = r^2/kt = (10)^2/(10)\ (10) = 1.000.$$

If the participant mistakes the ten added entries for subject entries and selects the added entries as well as the ten subject added entries, his score would be:

$$S = r^2/kt = (10)^2/(10)\ (10+10) = 0.500.$$

If for some reason, the patron selects only five of the relevant cards (and no other) his score is also:

$$S = r^2/kt = (5)^2(10)(5) = 0.500.$$

It must be emphasized that this success score has meaning only in relation to determining the relative success of the individual in differentiating between the desired relevant references and the non-pertinent (i.e., conflicting) references that may confuse him. Thus, the two scores above (for which S = 0.500) represent similar levels of effective use. The individual who must search twice as many cards as there are relevant cards in order to locate the relevant deck of references must be considered no more effective in using the catalog than the patron who selects only half of the relevant deck. The reason for achieving a score of less than 1.00 in one case is presumably different than the reason for receiving a score of 0.500 in the other. This relationship of score to cause of partial, rather than complete, success is examined in detail in Chapter V.

The expected differences between the matched pairs can be tested for statistical significance using the t-test for difference of means.[7] All statistical tests for hypothesis testing will be made at the .05 level; that is the probability of rejecting a true hypothesis will be set at 5 percent for all statistical tests.

The Wisconsin and Illinois Catalogs

Because of certain similarities--and geographical proximity--two large universities were selected as the focus for this study--the University of Illinois (with a dictionary catalog) and the University of Wisconsin (with a divided catalog). Both schools are large, midwest, state-supported universities of national reputation. Table 1 shows how similar, although not identical, the two schools are in respect to the distribution of the study body according to class standing. On the other hand, there is a rather large discrepancy between the size of the collections at Illinois and Wisconsin which could have an effect on the attempt to locate comparable sections in the two catalogs. Illinois' collection was listed as 4,083, 634 volumes for 1965-66 as compared to Wisconsin's 1,746,321 volumes.[8] The Wisconsin holdings do not include the collection housed at the Milwaukee campus nor

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[7] Allen L. Edwards, Statistical Methods for the Behavioral Sciences (New York: Holt, Rinehart and Winston, 1954), pp. 278-82.

[8] American Library Association. Library Administration Division, Library Statistics of Colleges and Universities, 1965-66: Institutional Data (Chicago: American Library Association, 1967), pp. 26, 82.

TABLE 1

DISTRIBUTION OF STUDENTS BY CLASS AT THE UNIVERSITY OF ILLINOIS AND THE UNIVERSITY OF WISCONSIN, FALL SEMESTER 1966-67

	Illinois		Wisconsin	
Class	Number	Percent	Number	Percent
Undergraduates				
Freshmen	6,324	21.7	5,847	18.8
Sophomores	5,144	17.7	6,484	20.8
Juniors	4,542	15.6	4,849	15.6
Seniors	4,583	15.7	4,311	13.9
Others*	193	0.7	394	1.3
Subtotal	20,786	71.4	21,885	70.4
Professional	836	2.9	1,013	3.2
Graduates	7,498	25.7	8,222	26.4
Total	29,120	100.0	31,120	100.0

*Category includes "unclassified" and "irregular" students at Illinois; "special" students at Wisconsin.

SOURCE: Illinois data provided by the Office of Admissions and Records (11/8/66); Wisconsin data provided by the Office of the Registrar (1/20/67).

do they reflect the collection of the State Historical Society of Wisconsin which may be considered an adjunct to the Wisconsin collection. Discounting some 332,500 volumes at the Chicago campuses, the Illinois catalog indexes more than twice as many volumes as Wisconsin's.

A preliminary visit to the Madison campus, however, indicated that many of the search-problems selected at Illinois (as described below) were comparable in size of file to those at Wisconsin. The largest discrepancies occurred among those entries that were most likely to represent local interests (e.g., the file size for references to documents by and about Stephen A. Douglas was expectedly larger at Illinois than at Wisconsin).

In regard to the physical size, the University of Illinois' alphabetically arranged dictionary catalog occupies 4,800 drawers and the University of Wisconsin's catalog consists of 1,232 subject drawers and 3,439 drawers in the author-title section. The Wisconsin catalog, according to a recent audit, consists of over 3,300,000 cards (approximately 924,000 subject cards and 2,407,000 author-title cards) as compared to well over 5,000,000 cards in the Illinois catalog.[9]

Far more important are the internal characteristics of the two catalogs. As might be expected, both libraries follow standard rules of cataloging, frequently using printed Library of Congress cards to supplement their own original cataloging. No difficulty was expected because of minor differences in the two catalogs: 1) subject added entries are indicated by black type on unit cards at Wisconsin while Illinois displays subject added entries by red type; and 2) added entries are interfiled in the Wisconsin author-title catalog (as per ALA rule 25a)[10] while at Illinois added entries are filed after main entries (and before subject added entries) resulting, generally, in three separate files for each specific heading.

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[9] Data for Wisconsin catalog based on a recent audit and provided by Mr. LeRoy D. Ortopan, Chief of Cataloging, on February 9, 1967. No recent audit of the Illinois catalog has been undertaken; the conservative estimate of five million cards was verified by Miss Betty Croft, Catalog Librarian.

[10] A.L.A. Rules for Filing Catalog Cards (Chicago: American Library Association, 1942), p. 25.

One important difference in filing, however, was considered significant enough to be a potential cause of some difficulty in making comparisons. In particular, the rule affects the filing order of subordinate agencies and units for headings under geographical names. The "United States" sections of the two catalogs is one example which had direct applicability to the study. At Wisconsin, subordinate agencies (e.g., U.S. Civil Service Commission) are filed after the general heading "United States" and its appropriate subdivisions. At Illinois, these subordinate agencies are treated, for filing purposes, to be indistinguishable from subject subdivisions. For example, subject entries for various headings under "United States" appear in the two catalogs in the following order:

Wisconsin	Illinois
U.S.--ALTITUDES	U.S.--ALTITUDES
U.S.--BIBLIOGRAPHY	U.S. ARMY
U.S.--CIVILIZATION	U.S. ARMY--BIBLIOGRAPHY
U.S.--FOREIGN RELATIONS	U.S.--BIBLIOGRAPHY
U.S.--HISTORY	U.S.--CIVILIZATION
U.S.--POLITICS & GOVERNMENT	U.S.--FOREIGN RELATIONS
U.S.--STATISTICS, VITAL	U.S.--HISTORY
U.S.--TERRITORIAL EXPANSION	U.S. LIBRARY OF CONGRESS
U.S. ARMY	U.S.--POLITICS & GOVERNMENT
U.S. ARMY--BIBLIOGRAPHY	U.S.--STATISTICS, VITAL
U.S. LIBRARY OF CONGRESS	U.S.--TERRITORIAL EXPANSION
U.S. WEATHER BUREAU	U.S. WEATHER BUREAU

Thus, the search for subject cards for the entry "U.S. Civil Service Commission" should be made between "U.S. Army--

Bibliography" and "U.S. Library of Congress" in the Wisconsin catalog. In the Illinois catalog, "U.S. Civil Service Commission" would be found between the entries for "U.S.--Bibliography" and "U.S.--Civilization."

Rather than eliminating such examples from the search-problems, it was decided to include them and to determine if this was the cause of success or failure more frequently at one school than at the other. If the data indicated that this difference did, indeed, affect the results, the problems would be deleted from the student's mean success score and would be analyzed separately.

Development of the Search-Problem Exercise

The actual selection of the search-problems was achieved by random sampling of the University of Illinois library catalog. The objective of the sampling was to obtain a list of personal, corporate and uniform entries that could be compared with the Wisconsin catalog. Without any knowledge of how many such headings would be found or how many would be necessary for matching with the divided catalog at Wisconsin, it was decided to obtain 480 random numbers (10 percent of the total number of drawers). It was also determined that the majority of drawers would not have more than ten inches of cards and a second set of random numbers was obtained to represent one inch of cards per drawer. Five hundred and twenty-five four-digit numbers and the same amount of single-digit numbers were drawn and combined--the first 480 unique combinations were used in the sampling. Thus, the numbers "9" and "0029" indicated that the ninth inch of drawer number 29 was to be audited. The initial audit produced 283 personal, corporate and uniform entries. In order to minimize the number of entries that might not be found in the smaller divided catalog, it was decided to reduce this list. The list was reordered into seven categories:

a) Main Entries only;
b) Non-subject Added Entries only;
c) Subject Added Entries only;
d) Main and Non-subject Added Entries;
e) Main and Subject Added Entries;
f) Non-subject Added and Subject Added Entries;
g) Main, Non-subject Added and Subject Added Entries.

Entries were then selected (or excluded) from the list on the basis of the following criteria: 1) entries represented by one or two cards were not selected if they were no different in form than others within that group; 2) entries representing obscure individuals or organizations were deemed to be no more representative than other entries in their category; and 3) selected entries were considered to be of a type that could more easily be stated as a search request than other entries in their category. The first two criteria could not be considered, within the nature of this study, to have had any appreciable effect on the final search-problems. The latter criterion, however, did result in the deletion of uniform headings which would have been awkward to state as problems. Such headings as "Georgia. Laws, statutes, etc." did not lend themselves readily to the type of search-problems desired and were, therefore, excluded. As a result of this procedure, 48 personal and corporate entries and two examples of criticisms were left as potentially usable subject searches.

A list of 200 conventional subject headings was compiled by sampling from the Library of Congress subject headings list.[11] The catalog of the University of Illinois was again audited to determine if these subject headings were actually used and to investigate the feasibility of including them as problems. Judgment as to feasibility was based on the desire that there be some potential conflicts between subject headings and similar, although not identical, titles. Furthermore, subject headings were selected if they seemed to lead to convenient solutions regardless of the possible interpretation of the patron. From this list only nine subject headings were determined to be potentially usable.

Pre-Test of the Exercises[12]

Prior to the final comparison of the appropriate sections of the two catalogs used in the study, a pre-test was conducted. The purpose of the pre-test was: 1) to determine the effect, if any, of the various forms for wording the question that had been considered; 2) to determine the total number of questions that might be asked in a one-hour test period; and 3) to determine if patterns of search actually were similar enough to predict the general sections of the catalog that should be compared.

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[11] Subject Headings Used in the Dictionary Catalogs of the Library of Congress (6th ed.; Washington, D.C.: Library of Congress, 1957).

[12] For forms used in the pre-test, see Appendix A.

The pre-test was conducted in September 1966 with 28 members of the introductory class in cataloging in the Graduate School of Library Science at the University of Illinois. The exercise was conducted in lieu of a first week laboratory assignment in cooperation with the instructor of the course. Class members were instructed to sign up for a one-hour period at which time they reported to the investigator. Each student completed a "General Information Sheet" and was informed of the purpose of the exercise and the procedure. Inasmuch as this was a pre-test intended to determine the appropriateness of the method, students were encouraged to ask questions if the instructions or the problems were not clear or seemed ambiguous. The participant then conducted the series of eight searches at the main catalog in the presence of the investigator. As each student went through the problems, the investigator took note of the procedure and final decision. By varying the combination of searches, each of the final 59 subjects was searched at least once. Note was also made of the time the searches were begun and completed, yielding a total time elapsed (rather than individual times for each question).

As noted before, there was some concern over the wording of the problems which led to the decision to vary the question during the pre-test phase. Basically, there were five methods of asking for similar items:

Q_1 : Locate the appropriate catalog cards that indicate the library contains documents about the topic:

Q_2 : Locate the appropriate catalog cards that indicate the library contains documents about:

Q_3 : Locate the appropriate catalog cards that indicate the library contains documents about (rather than by):

Q_4 : Locate the appropriate subject cards in the university card catalog for the following:

Q_5 : Assume you have the text of the title listed below, locate the appropriate catalog cards that indicate the library contains documents about:

These basic forms of the question were combined in the following manner for four groups of students:

TABLE 2

FORM OF QUESTION USED FOR FOUR GROUPS OF STUDENTS

	Student Group			
Type of Problem	I	II	III	IV
Conventional Subject	Q_1	Q_1	Q_1	Q_4
Person as a Subject	Q_2	Q_1	Q_3	Q_4
Corporate Entry as a Subject	Q_2	Q_1	Q_3	Q_4
Criticism	Q_2	Q_1	Q_5	Q_4

It was assumed that the form and the results of the search-problems are independent. This was tested by the null hypothesis, that there is no relationship between the form of the question and the frequency of failure, success, or partial success. Each student's response was scored in a very general way as being completely correct, partially correct, and completely incorrect. A 4 x 3 contingency table was created and the independence of the two variables (form and response) tested by computing a chi-square. The observed and calculated expected frequencies (given in parentheses) are shown in the accompanying table.

TABLE 3

OBSERVED AND EXPECTED FREQUENCIES FOR PRE-TEST DATA

Student Group	Failure	Partial Success	Success	Total (Rows)
I	34 (30.4)	26 (26.8)	20 (22.9)	80
II	19 (18.2)	17 (16.1)	12 (13.7)	48
III	10 (12.1)	10 (10.7)	12 (9.1)	32
IV	22 (24.3)	22 (21.4)	20 (18.3)	64
(Column Total)	85	75	64	224

The computed value of chi-square was 2.83. At the predetermined level of a probability of 5 percent occurrence of a Type I error and for 6 degrees of freedom, the computed value is not significant. Therefore, there is no reason to reject the null hypothesis that form (Q) and Success-Failure are independent and not related. The final decision as to the style of the question could be selected from any form and should have no effect on the results. It was determined, from remarks by some (but not all) students, that changes in the statement of the "criticism" problem would make it more clear so that the questions used for the third group of students were selected for the final search-problems. In addition, the meaning of the term "document" was not clear to all students--most interpreted the term to mean some governmental or official publication--and the word "material" was substituted.

Elapsed time to complete the eight searches was obtained for 27 of the 28 participants. Times ranged from a low of 13 minutes to a high of 63 minutes. A mean time of 31 minutes and a standard deviation of eleven minutes was computed. Based on these data it was determined that the final exercise would contain no more than twelve problems requiring an average of just less than 47 minutes. The remaining part of the hour was planned for explaining the procedure and post-test interviews.

Observation of the procedure and patterns of searching seemed to justify the assumption that for specific requests the appropriate sections of the catalog could be determined. As was expected, there were instances when the participant selected to search the catalog for less specific subjects than the ones presented. Post-test interviews revealed that rewording the subject request would in no way have made it clearer to the participant that such a subject actually was used in the catalog. There was no reason, however, to suspect that this same problem (another cause for failure) would not occur with the two final test groups nor to expect that this would occur more frequently with the users of one type of catalog than the other. Of particular interest was the relatively consistent pattern of search whether it was for the precise subject heading requested or for a less specific term.

One difficulty led to a major change in the final selection of the search-problems. Most students participating in the pre-test appeared to conclude that the search was sufficiently complete when they had discovered some cards appropriate to the question. In those cases in which the requested subject (a person or corporate entry) was not represented by subject or non-subject added entries, there was some reluctance on the part of the student to say "there are none" and many began to search under other headings. To avoid this difficulty, those questions were excluded from the final set of potentially useful problems. This reduced the final comparison between the two catalogs to nine conventional subject headings, 26 personal authors, two criticisms and five corporate entries as subject headings.

As a further result of the pre-test, it was discovered that the class standing was not a sufficient basis for indicating potential experience and familiarity with the main catalog. This was due, in many cases, to the number of graduate students who had enrolled at Illinois after completing their undergraduate work at other schools. While the final test group did not include graduate students, the possibility of drawing transfer students in the sample could result in similar difficulties. The General Information Form was revised to include a request for the total number of semesters each student had spent on the campus of his respective institution.

Final Comparison

The final comparison of the two catalogs was conducted two weeks prior to the commencement of the testing. Three conventional subject headings, eleven personal names as subjects, one criticism and three corporate entries were judged to be similar enough for the purposes of this study. To test the assumption that known-item searches would not be affected by the arrangement of the catalog, two questions were prepared with information about the author and title. The remaining ten questions were selected from the 18 comparable sections of subject cards. All three conventional subjects, and three corporate entries as well as the criticism, were selected. A final decision remained to select three of the eleven author headings. One, Jackson Pollock, was identical in the two catalogs and was included. The second, Otto Ludwig, was selected because of the language--requiring precise identification of the meaning of the subject heading and reducing the effect of other bibliographical information on the card. The third personal author was selected to represent a compound name to see what search patterns would develop. The entry selected was for Mirabeau for whom the established entry is: Mirabeau, Honore Gabriel Riquetti, comte de. During the preliminary comparison of the two catalogs it was discovered that cross references from the unused to the used form for an entry were to be found, at Wisconsin, in the author-title catalog only. To investigate the effect of this procedure on the use of the subject catalog it was decided to vary the request for material about Mirabeau. Thus, some students received the request to find material about (rather than by) "Honore Gabriel Riquetti" and others for "Honore Gabriel Riquetti (Count Mirabeau)." Since this did not represent the same search for all individuals, the results were not included in the computation of the mean success score. Hence, the success score would be computed by taking the mean for the scores achieved for the single criticism, the three conventional subjects, two persons-as-subjects, and either one or three of the corporate entries as subjects (depending on the test to evaluate the effect of the difference in alphabetical arrangement between the two catalogs).

The final group of questions, and alternatives, is given in Appendix B. An analysis of the final search-problems and the effects of slight differences in the file sizes on the computation of a meaningful success score are discussed in detail in the succeeding chapters.

Selection of the Participants

The selection of participants was achieved by random selection from the undergraduate population of the two universities chosen for the study. Since lists of the student population by classes could not be secured, the student directories of the respective schools were used. Random selection was used in order to meet one of the underlying assumptions for statistical test--random selection from a normally distributed population--and to reduce any unknown bias in response rate that may result from other selection techniques. The anticipated statistical tests also dictated the desirability of having at least 30 matched pairs. Based on a predicted rate of undeliverable mail (10 percent) and a predicted rate of response (30 percent) it was decided to select 200 names from the Wisconsin directory and 300 names from the Illinois directory.

The Illinois directory contains 97 entries per page on 298 pages plus 46 entries on the final page, a total of 28,952 names. This figure is slightly smaller than the total number of registered students as given in Table 1. The Wisconsin directory contains a varying number of entries per page with three columns to the page. A sample of 25 columns indicated that there was an average of 72 names per column with some columns having as few as 68 and as many as 78 entries. Random numbers for page and entry for Illinois and page, entry and column for Wisconsin were selected and combined. Combinations of digits that yielded entries outside the universe (graduate students or other unclassified students) were excluded. This procedure yielded 216 names for Wisconsin students and 331 Illinois students.

Letters requesting the participation of Illinois and Wisconsin students were mailed to their campus addresses so as to arrive during the first day of the second semester of the 1966-67 academic year. Wisconsin students indicated willingness to participate by returning a post card; Illinois students were asked to complete and return the General Information Form (see Appendix C). This form was completed later by the Wisconsin students. A summary of the response rate is given in Table 4.

Upon arrival on the Madison campus, the investigator called each student and scheduled him for a one-hour period

TABLE 4

RESPONSE RATE TO LETTERS REQUESTING PARTICIPATION

	Wisconsin	Illinois
Number of letters sent	216	331
Undelivered (Returned)	9	11
Total delivered letters	207 (100%)	320 (100%)
Responses		
Willing to participate	81 (39.1)	146 (45.6)
Unable to participate	5 (2.4)	9 (2.8)
No response	121 (58.5)	165 (51.6)

during the second or third week of classes. The hour selected was arranged so that it did not coincide with class periods, thus assuring the investigator a full hour with each student without concern over class conflicts. The need to conduct the test during all hours of the day decreased the opportunities for locating and scheduling Wisconsin participants to a greater degree than at Illinois (where assistants were available). An error in scheduling during the seventh day of the Wisconsin phase resulted in two students reporting at the same time. Under the expedience of necessity it was found to be no hardship to have two students on the floor at the same time. This field-tested change proved to be a necessity during the latter days of the Illinois phase. As a result it was possible to complete 56 hours of floor time in 54 hours at Wisconsin and 115 hours of floor time in 81 hours at Illinois. The Illinois phase of the study, dealing with a larger group of students, was begun during the third week of classes and completed in the seventh week.

Summary

The objective of the study was to determine if arrangement of subject entries into a separate file would result in a significant change in the effective use of a library catalog. The design of the study was developed in terms of the variables that must be considered in an experimental approach to testing the hypothesis--the question, the catalog and the user. A set of search-problems was developed as a data collecting instrument and a formula for scoring the results was devised. Two catalogs--one in dictionary arrangement, the other divided into subject and non-subject entries--were selected and the appropriate sections verified in regard to similarity in size and complexity. Undergraduate students from the two universities were randomly selected and letters were sent inviting them to participate in the study.

In the process of developing the design for collecting data, a number of assumptions were enumerated. This led to a second, and equally important, objective of the study: to utilize the data secured to explore the appropriateness of the matching procedure and the validity of the test instrument.

CHAPTER III

COLLECTION OF THE DATA

The purpose of this chapter is to describe the procedure used in securing the test data as well as the method and results of matching Illinois and Wisconsin participants. Two problems connected with the test instrument are also discussed. Succeeding chapters will describe the testing of the major hypothesis and the investigation of the validity of some of the underlying assumptions.

The Test Groups

The letters requesting students to participate in this study resulted in 81 affirmative responses from the students contacted at Wisconsin and 146 from Illinois. Upon arrival of the investigator on the Madison campus, students were called and appointments were arranged. Some difficulty in reaching a few of the respondents resulted in further reduction in the number of students actually included in the study. In addition, a few students indicated that the available hours were inconvenient or had reconsidered the demands of their course work and requested that they be withdrawn from the test group. Similar problems in scheduling or contacting students by telephone also reduced the number of final participants at Illinois. Since it was more important, for purposes of matching convenience, a greater effort was made to contact all students at Illinois. Seventeen students who could not be reached by phone were sent a post card requesting them to call for an appointment. Table 5 is a summary of the actual number of participants for each school.

TABLE 5

TOTAL NUMBER OF PARTICIPANTS IN THE STUDY

	Wisconsin	Illinois
Total affirmative responses	81	146
Requested to be withdrawn	7	11
Unable to contact	16	10
Contacted and scheduled	58	125
Scheduled but did not appear	2	10
Produced unusable data	6	21
Final test group	50	94

Of the total 171 students who took part in the study, five Wisconsin students and 18 Illinois students were unable to complete the search-problem exercises within the alloted period of time. In addition, four students (one at Wisconsin and three at Illinois) who were listed as underclassmen in their respective directories were found to be enrolled in professional programs and in their fifth or sixth year of college. These students were considered to be outside of the intended student universe and were deleted from the study. The final number of usable scores was 50 students at Wisconsin and 94 at Illinois, a total of 144 participants. The distribution of participants by sex and class is given in the following table:

TABLE 6

CHARACTERISTICS OF THE FINAL TEST GROUPS

	Wisconsin			Illinois		
Class	Female	Male	Total	Female	Male	Total
Freshmen	12	3	15	12	22	34
Sophomores	2	4	6	10	12	22
Juniors	10	9	19	8	11	19
Seniors	2	8	10	7	12	19
Totals	26	24	50	37	57	94

Data Collection Procedure

The procedure in conducting the search exercises was similar at the two schools with two exceptions. The Wisconsin students were required to complete the General Information Form at the time they appeared for their appointments. Illinois students, who had completed the Form as an indication of willingness to participate, were asked only to clarify or explain any responses which were not clear. Wisconsin students reported to the main public catalog room in the University library where the investigator was located at a large study table at the rear of the room. Instructions, interviews and the exercises were all conducted in that room. At Illinois, students reported to the investigator's office, located on the fourth floor of the main library building, and were escorted to the main catalog (on the second floor) after the instructions were given. Some of the instructions and post-test interviewing took place while going to or returning from the catalog. This small variation may explain the slightly higher rate of uncompleted exercises at Illinois (12.3 percent) as compared to Wisconsin (8.9 percent).

Students were informed of the purpose of the exercise and the procedure to be used.[1] The participant was then instructed to complete the searches, indicating his answers to the investigator rather than writing his response on the card containing the question. Questions were presented to the participant on 4" x 6" cards as illustrated in Figure 1. All

FIGURE 1: SEARCH-PROBLEM FORMAT

Locate the appropriate catalog cards that indicate
the library contains material about the topic:

Statistical design

( ) None in the university catalog.
( ) Cards located in drawer(s) number: ________
____
____
____

Search No.: __________

---

[1] See Appendix D for "Investigator's Interview Schedule."

exercises were then completed with the investigator present. In those cases when there were two students being tested at the same time, each student was instructed to wait for the investigator to note the answer before proceeding to the next problem.

The arrangement of the catalogs at Wisconsin made it possible to keep the students in sight and to note their procedure. These notes were later verified as the participants were asked to verbalize their procedure after reaching a conclusion. At Illinois, the presence of the public shelflist in the center of the floor occasionally obscured some students. By noting what question each participant was searching, it was possible to be located in such a position as to minimize this physical obstruction. Whenever this was not possible, each step of the search strategy was verified with the student. There was no apparent indication that this modification in procedure in any way invalidated the data collected; it may, in fact, have reduced any upsetting effects of the investigator constantly being present during the search.

In support of this contention, the success scores for the Illinois group were used to test the hypothesis that there was no significant difference between the group means of those who conducted the searches alone and the students who were tested two at a time. While the two groups were not randomly selected, an underlying assumption of most statistical tests, the scheduling of individuals in hours convenient to the examiner and the participant, the failure of some students to appear and the arrangement of appointments by three different people would seem to have decreased any systematic bias in the assignment of hours.

Statistical measures for the participants who performed alone (Group I) and for those who performed in pairs (Group II), given in Table 7, were computed and no difference between the means was observed.

TABLE 7

STATISTICAL MEASURES FOR THE TWO ILLINOIS GROUPS

Group	N	X	X^2	$\bar{X}$	S^2	S
I	42	18.013	8.612	0.429	0.021	0.145
II	52	22.291	11.168	0.429	0.031	0.176

As each participant searched the catalog to find the appropriate cards, the investigator noted the procedure as well as the final decision. Every effort was made to secure information about where the individual searched, what specific heading he or she had in mind, the type of problem that might be encountered, etc. For example, one participant's response for the problem shown in Figure 1 was:

> Participant (search number 023) first searched under the heading "Design, Statistical" in the appropriate sequence of the alphabet, found nothing and continued to scan through drawer;

Second search was under "Statistical," found a cross-reference under "Statistical design" and went to:

"Experimental Design"; indicated all cards with the subject added entry as appropriate.

During the instruction period students were informed that the test questions had been selected randomly and that some of the requests might not represent areas of interest to them. It was assumed, however, that the student could cope with the request at a level determined by his basic knowledge about the catalog. At the termination of each session, a post-test interview was conducted. One of the questions asked of the participant was "Did you find that the problems and your responses were a fair indicator of your general knowledge of the scope and arrangement of the catalog?"

The replies of the students, admittedly testimonial, indicated no reason to suspect the validity of this approach to measuring effective use. Some students, however, were troubled by the abstraction of the problems, saying that they wouldn't start to look for answers to some of the questions in a catalog but would prefer, rather, to use some reference tool or search the periodical literature. This criticism can be considered to be a legitimate objection to the specific questions rather than an indictment of the procedure and must be considered a limitation to the study.

Matching Illinois and Wisconsin Students

While the Wisconsin phase was being completed, Illinois students had returned the completed General Information Form as an indication of their willingness to participate. The purpose of using the Form rather than a post card reply was to permit matching students prior to scheduling. This procedure was abandoned when it became clear that not all students might complete the exercise or that some students would change their minds about participating or forget their appointments. The Illinois participants, therefore, were scheduled and completed the search-exercises prior to matching.

In very general terms, the matching was successful to the extent that 31 pairings were made. While there were some differences between the matched pairs, every effort was made to have the two primary criteria ("semesters on campus" and "frequency of use of the main catalog") as equal as possible. To facilitate comparison, the responses to the question of frequency of use of the catalog have been converted to a code score as given in Table 8.

One criterion for which information was secured on the General Information Form was not used in the matching procedure. In the course of conducting the pre-test interview it was determined that the responses to the question on the "frequency of use of departmental catalogs" were not comparable. Most Wisconsin students interpreted this question

TABLE 8

CODE FOR "FREQUENCY OF CATALOG USE" RESPONSE

Frequency of Use	Code
Less than once a semester	1
1 or 2 times a semester	2
3 to 5 times a semester	3
6 to 10 times a semester	4
11 to 15 times a semester	5
16 or more times a semester	6

to mean the Wisconsin reserve book catalog. The catalog, which is on key-punched cards, is sufficiently different in format and content to make it meaningless to compare it with the more conventional departmental catalogs located at the two schools.

Basic information about the participant, as listed in Table 9, was then typed on a card and these were separated into groups according to the number of semesters on campus. These groups were subdivided into categories according to the frequency of the use of the main catalog and subsequent matching was accomplished by scanning other characteristics. (This information plus the success ratio for each question was later entered on machine-readable cards for computer analysis.)

TABLE 9

CHARACTERISTICS OF MATCHED PAIRS OF STUDENTS*

Student Identification	Semesters on Campus	Catalog Use	Sex	Class	GPA	Major
006	3	2	M	4	2.7	Political Sci.
461	3	2	M	2	3.9	Economics
007	1	3	M	3	3.5	Civil Engr.
507	1	3	M	1	3.8	Mech. Engr.
008	7	2	M	4	3.3	Economics
513	7	2	M	4	3.0	Psychology
009	3	1	M	2	3.2	English
488	3	1	F	2	2.8	English
011	1	2	F	3	3.5	Social Work
510	1	2	M	3	4.0	Sociology
012	3	1	M	2	3.1	Business
478	3	1	M	2	3.1	Finance
013	1	2	M	3	3.0	Chemistry
532	1	2	M	1	2.3	Pre-Dentistry
014	1	1	M	1	3.2	Pre-Commerce
487	1	1	M	1	3.0	Accounting
015	1	1	F	1	3.1	Nursing
504	1	1	F	1	2.1	Nursing
016	3	4	M	2	3.1	Sociology
473	3	4	M	2	3.3	Administration
019	1	4	F	1	4.8	French
502	1	4	F	1	4.5	Latin Am. Studies
020	5	6	F	3	4.1	Psychology
531	5	5	F	3	3.9	History
021	3	4	F	3	3.8	History
498	3	4	F	3	3.6	English
023	3	2	F	3	4.1	Zoology
466	3	2	F	2	4.0	Home Economics
029	1	1	M	3	3.9	Education
457	1	1	M	1	3.7	Psychology
030	7	4	M	4	4.3	History
471	7	4	M	4	4.5	Anthropology
032	1	1	F	1	3.8	Liberal Arts
528	1	1	M	1	3.7	Education
035	5	1	M	3	3.6	Chemistry
523	5	1	M	3	3.3	Mech. Engr.

TABLE 9 (continued)

Student Identification	Semesters on Campus	Catalog Use	Sex	Class	GPA	Major
036	1	1	F	1	3.6	Medical Tech.
516	1	1	M	1	3.5	Pre-Dentistry
037	7	1	M	4	3.6	Civil Engr.
557	7	1	M	4	3.5	General Engr.
038	5	3	M	3	3.6	Economics
567	5	3	F	3	3.5	Retailing
039	6	4	F	4	3.1	Social Work
505	6	4	F	4	3.4	Social Studies
042	1	1	F	1	3.7	French
501	1	1	F	3	3.5	Art Education
045	1	2	F	1	3.6	Art Education
526	1	2	F	1	3.7	Elem. Education
047	1	4	F	2	4.6	English
451	1	3	F	2	4.7	English
048	1	1	M	1	3.6	Chemistry
546	1	1	M	1	3.5	Electrical Engr.
050	7	5	F	4	3.1	English
459	7	4	F	4	3.4	English
055	1	1	M	1	2.0	Agric. Engr.
462	1	1	M	1	2.5	Aeron. Engr.
056	3	1	F	2	3.7	History
519	3	1	F	2	3.8	Elem. Educ.
058	1	3	F	3	4.2	Political Sci.
493	1	3	F	3	4.2	Speech Educ.
060	7	1	M	4	3.5	English
495	7	1	F	4	3.4	Anthropology

*The codes for the various columns of characteristics are as follows: For "catalog use" see code as given in Table 8; for "class," 1 = Freshmen, 2 = Sophomores, 3 = Juniors and 4 = Seniors; the Grade Point Average (GPA) is based on a five-point system (A = 5.0).

Computation of the Mean Success Scores

All responses to the test questions were scored using the success ratio formula (see p. 28). The success ratios were then used to compute a mean success score for each individual. As noted previously, a number of factors had to be considered in determining which of the questions would be included in the final success score. One of these was the matter of alphabetical arrangement of subordinate agencies (as outlined in Chapter II). A second factor was the slight difference in some of the card files at Wisconsin and Illinois.

The effect of differences in filing.--As indicated, the success ratio for searches for which the appropriate entry is a subordinate agency may be affected by the differences in file organization as well as by the possible confusion between subject added entries and non-subject added entries. To test the effect of filing, the two questions which were directly affected were analyzed. The problems, as presented to the students, were stated as follows:

> Locate the appropriate catalog cards that indicate the library contains material about (rather than by): The U.S. Civil Service Commission.
>
> Locate the appropriate catalog cards that indicate the library contains material about (rather than by): The Great Britain Board of Trade.

The analysis was based on an examination of the procedure followed by students at Wisconsin and Illinois. Two general alternatives were considered: 1) the patron selected the appropriate term to search, or 2) the patron selected some other term to search (e.g., under "Civil Service" rather than "U.S. Civil Service Commission"). Frequencies for those who chose the correct search term were tabulated. The category "found" includes all students who located the term even if the student made some subsequent error in selection of cards. The expected and observed frequencies (in parentheses) for the two questions are given in Tables 10 and 11.

TABLE 10

OBSERVED AND EXPECTED FREQUENCIES FOR "U.S. CIVIL SERVICE COMMISSION" PROBLEM

Catalog	Found	Did Not Find	Total (Rows)
Wisconsin	8 (13.18)	7 (1.82)	15
Illinois	50 (44.82)	1 (6.18)	51
(Total: Columns)	58	8	66

The calculated value of chi-square for the measures given in Table 10 is 21.72, which is significant at the .05 level for one degree of freedom. Therefore, it was determined that the difference in filing actually did have an effect on the possible success or failure in searching for this problem and the score was deleted from the computation of the mean success score.

TABLE 11

OBSERVED AND EXPECTED FREQUENCIES FOR "GREAT BRITAIN BOARD OF TRADE" SEARCH

Catalog	Found	Did Not Find	Total (Rows)
Wisconsin	21 (18.82)	10 (12.18)	31
Illinois	30 (32.18)	23 (20.82)	53
(Total: Columns)	51	33	84

The calculated value for chi-square for the frequencies given in Table 11, which is 1.02, is not significant at the .05 level for one degree of freedom. For this reason, the "Great Britain" question was not excluded from the computation of the mean success score. The curious difference of the effect of the filing on the two problems is examined in some detail in Chapter V.

The final mean success score, therefore, was an average of the success ratio for three conventional subject searches, one criticism, two corporate entries as subject headings and two personal entries as subject headings, a total of eight searches.

The effect of file size differences.--The file size of the subject portions of the two catalogs should be identical in order to ensure similar results for identical procedures.

The use of existing catalogs at two different institutions, however, required that some latitude be allowed. While the file size of some entries such as "Jackson Pollock" and "Amateur Athletic Union" were identical (three and one entries, respectively) others, such as "Experimental Design" varied (58 at Illinois, 52 at Wisconsin). These small differences were considered to be less serious (and nothing in the test procedure contradicted this assumption) than differences in two of the other files. The problem was one in which the confusing (or inappropriate) entries were contained within the subject files.

The "Otto Ludwig" file at Wisconsin contained 29 subject added entries and an additional eight criticisms of various Ludwig titles. Illinois' file, on the other hand, contained 34 subject added entries and ten criticisms. Technically (and for the purposes of this study, accurately), the criticisms are not appropriate responses to the question asked. The individual who may select "all the red ones" at Illinois--which happened quite frequently--or all entries in the subject catalog at Wisconsin without discrimination, would be given the following scores:

$$\text{Wisconsin:}\quad S = \frac{r^2}{kt} = \frac{(29)(29)}{(29)(37)} = 0.784;$$

$$\text{Illinois:}\quad S = \frac{r^2}{kt} = \frac{(34)(34)}{(34)(44)} = 0.773.$$

For identical searches and decisions, the Illinois student would receive only 98.6 percent of the Wisconsin student's score; an adjustment by this figure to the Wisconsin score should be made.

Similarly, the total "Firearms" file at Wisconsin contained 55 entries, of which two are the appropriate "Firearms--Identification" entries. The Illinois file contains 94 cards of which five contained the appropriate heading and three were title added entries. Again, numerous students at Illinois and Wisconsin indicated that they believed all entries under Firearms (and its various subdivisions) would be the appropriate cards. This decision must be considered partially correct since the appropriate cards are contained within the indicated deck. Computing success ratios for the two catalogs yields a score of S = 0.036 at Wisconsin and S = 0.055 at Illinois (deleting the conflicting title added entries). Thus, the Wisconsin score yields only 65.5 percent of the value at Illinois, although these are identical searches; the Wisconsin score should be corrected by a factor of approximately 1.53.

When the correction factors are used to create new success scores, the difference is relatively small. Table 12 gives the mean success scores computed with the original uncorrected method (designated the "raw" score) and the values using the correction factor for eight individuals affected by both corrections.

TABLE 12

COMPARISON OF EIGHT WISCONSIN MEAN SUCCESS SCORES WITH CORRECTION FACTOR FOR "FIREARMS" AND "LUDWIG" SEARCHES

Student Number	Raw Score	Corrected Score	Student Number	Raw Score	Corrected Score
013	.353	.354	037	.603	.604
018	.348	.351	040	.103	.104
022	.478	.479	041	.130	.132
030	.728	.729	060	.228	.229

While the difference between these scores for each individual is statistically insignificant (using a t-test for difference between means) it does demonstrate the potential cumulative effect upon the total success score and the possible bias that would result from all files being slightly different in favor of one catalog.

Mean success scores for the 31 pairs of students were calculated without using the correction factor. The results of the test of the hypothesis is described in the following chapter.

Summary

Usable data from 50 Wisconsin and 94 Illinois students was secured over a six-week period during the second semester of the 1966-67 academic year. Information about various personal characteristics and catalog use habits was gathered from all participants. Based on this information, 31 pairs of Wisconsin-Illinois students were designated and the mean success scores of these individuals were used to test the major hypothesis.

Due to some peculiarities in the search procedure associated with a difference in filing rules, one question was deleted from the computation of the mean success score. For the purpose of testing the hypothesis, the success score of the final test group represented an average of each student's scores on eight questions: three conventional subject searches, one criticism, two corporate entries as subject headings and two personal entries as subject headings. The results of the test of the hypothesis and the investigation of some of the underlying assumptions are described in Chapter IV.

CHAPTER IV

ANALYSIS OF THE DATA

This chapter contains the results of the test of the major hypothesis. In addition, the effects of the arrangement of the catalog on known-item searches is analyzed. A third objective is the analysis of a number of assumptions enumerated in previous chapters upon which the validity of the investigative procedure is based.

The underlying assumptions can be classified according to their effect on three aspects of the study. One assumption concerns the appropriateness of the criteria selected for the matching of the respondents. Second, there are certain assumptions relating to the construction and validity of the test instrument. Data pertinent to these two assumptions are analyzed in this chapter. In the following chapter, a third assumption concerning the predicted similarity of patterns of search, using either catalog, is explored in detail as part of the general description of catalog search procedures.

Testing of the Hypothesis

Mean success scores, based on eight searches, were calculated for the 31 pairs of students. The original hypothesis to be tested was:

> Assuming all other factors are equal, subject searches through a catalog in which the subject entries have been separated (e.g., a divided catalog) will produce more pertinent references and less inappropriate references than identical searches using a file combining all entries into a single (dictionary) sequence.

Given a mean success score which represents the number of pertinent and/or inappropriate references retrieved for a specific subject search, the hypothesis can be restated as follows:

> Assuming all other factors are equal, the mean success score for an individual using a divided catalog will be significantly greater than the resulting score for the same searches using a dictionary catalog.

Testing the null hypothesis (i.e., no difference between groups), a _t_-test for difference between means was used to determine the statistical significance of the experimental data.

A summary of the data for the 31 pairs is given in Table 13. (Complete calculations of the _t_-test are given in Appendix E.) For 30 degrees of freedom (N-1), the expected value of the _t_ statistic at the .05 level for a one-tailed test is 1.697. That is, a value of _t_ calculated from the test group can be expected to be 1.697, or less, by chance alone.

TABLE 13

DATA FOR THE 31 MATCHED PAIRS

Pairs Wis. - Ill.	Wis. Scores	Ill. Scores	(X_1-X_2) D	$(X_1-X_2)^2$ D^2
006 - 461	.723	.298	.425	.1806
007 - 507	.723	.381	.342	.1169
008 - 513	.598	.500	.098	.0096
009 - 488	.348	.266	.082	.0067
011 - 510	.356	.294	.062	.0038
012 - 478	.473	.453	.020	.0004
013 - 532	.353	.111	.242	.0585
014 - 487	.147	.315	-.168	.0282
015 - 504	.125	.467	-.342	.1169
016 - 473	.875	.667	.208	.0432
019 - 502	.360	.772	-.412	.1697
020 - 531	.375	.480	-.105	.0110
021 - 498	.723	.347	.376	.1413
023 - 466	.598	.401	.197	.0388
029 - 457	.473	.442	.031	.0009
030 - 471	.728	.580	.148	.0219
032 - 528	.598	.339	.259	.0670
035 - 523	.723	.621	.102	.0104
036 - 516	.371	.314	.057	.0032
037 - 557	.603	.728	-.125	.0156
038 - 567	.348	.298	.050	.0025
039 - 505	.996	.474	.522	.2724
042 - 501	.598	.478	.120	.0144
045 - 526	.598	.480	.118	.0139
047 - 451	.683	.612	.071	.0050
048 - 546	.723	.343	.380	.1444
050 - 459	.223	.250	-.027	.0007
055 - 462	.250	.267	-.017	.0002
056 - 519	.598	.450	.148	.0219
058 - 493	.000	.529	-.529	.2798
060 - 495	.228	.371	-.143	.0204

The experimental data were tested for significance using the following formula:

$$t = \frac{\overline{X}_1 - \overline{X}_2}{s_{\overline{x}_1 - \overline{x}_2}} = \frac{.501 - .430}{.0423} = 1.678.$$

From the evidence of the experimental group, there is no reason to reject the null hypothesis that there is no difference between the two groups. Assuming the validity of the underlying assumptions appropriate to the procedure for matching and testing, the divided catalog did not result in a more effective catalog for the two groups. Since confusion about the differences between similar headings used to designate subject and non-subject entries was observable during the study (as discussed in Chapter V), it must be concluded that this cause for failure is not a significant contributor to the predictable level of effective use of a catalog.

It is only natural, then, to inquire if the arrangement of the catalog does not increase or decrease the effective use of the catalog in making subject searches, does arrangement have an effect on known-item searches? In order to collect evidence to support the hypothesis that difference in arrangement does not affect known-item searches, two questions were included in the search-problem exercises that were non-subject searches. Table 14 is a summary of the observed and

TABLE 14

OBSERVED AND EXPECTED FREQUENCIES IN SUCCESSFULLY LOCATING THE CALL NUMBER FOR THE "NAGEL" QUESTION

Catalog Used	Found	Did Not Find	Total (Rows)
Wisconsin	50 (50)	1 (1)	51
Illinois	101 (101)	2 (2)	103
(Total: Columns)	151	3	154

expected frequencies of success and failure in locating the call number for the book by Ernest Nagel. The table includes the responses of all students completing this problem.

Since there is no difference between the expected and the observed frequencies the value of the statistic chi-square is zero. There is no reason, therefore, to suspect any relationship between the frequency of success and the arrangement of the catalog.

For the frequencies given in Table 15, the computed chi-square also was not significant (chi-square = 0.6). Therefore, there is no evidence to indicate a significant difference in successfully locating known-items in one type of catalog or another.

<ins>Conclusions</ins>.--Based on the evidence of the experimental study described, there is no reason to suspect that

TABLE 15

OBSERVED AND EXPECTED FREQUENCIES
IN SUCCESSFULLY LOCATING THE CALL NUMBER
FOR THE "WARREN COMMISSION REPORT" QUESTION

Catalog Used	Found	Did Not Find	Total (Rows)
Wisconsin	33 (35.2)	21 (18.8)	54
Illinois	70 (67.8)	34 (36.2)	104
(Total: Columns)	103	55	158

dividing a catalog is a satisfactory device for making the subject approach more effective--inasmuch as it did not result in significantly reducing the failure attributed to the confusing of non-subject entries with subject entries. At the same time, there is no evidence to support the belief that dividing the catalog would actually reduce effective use either in respect to subject searches or known-item searches. These conclusions, however, must be considered tentative for two reasons. First, the study dealt with students attending two large mid-west universities and in no way can inferences be made to divided and dictionary catalogs in general, with any degree of confidence, without replication of the study. Second, the validity of the underlying assumptions of the study is subject to objective verification. The remainder of this chapter contains a description of the analysis undertaken to substantiate the appropriateness of some of these assumptions.

Validation of the Matching Procedure

The matching of the participants was predicated on the assumption that frequency of use and the number of semesters on campus constituted the best criteria for equating individuals. This assumption was considered most appropriate when note is made of one of the conclusions in the Jackson study that "The patron's inexperience and unfamiliarity with the catalog was another principal source of difficulty."[1] In order to compare these two primary criteria with other potentially useful characteristics for matching, a series of questions was asked of the participants on the General Information Form (Appendix C). Data on the following characteristics were collected: 1) semesters on campus and class standing (also converted to semesters in college) as measures of exposure to the catalog; 2) frequency of the use of the main catalog as a measure of familiarity; 3) sex; 4) cumulative grade point average; 5) most common approach to using the catalog; 6) the type and amount of instruction received in "how to use the library"; and, 7) work experience in libraries.

The procedure for analyzing these data was to investigate the relationship between personal characteristics and the students' performance at each school. This analysis was based on the concept that one or more characteristics could be shown to be related to the mean success score at each school. By examining these characteristics it could be determined if they were common to the two schools and therefore generally applicable as criteria for matching. Thus, for each school, identical questions (a constant) were searched using the same catalog (also a constant) by different participants. Hence, the differences in the success scores must be attributable to the participant's conduct of the search, rather than to the question or the catalog. Since these comparisons were made within schools, there was no reason for not including the "U.S. Civil Service Commission" question that was deleted in the comparison of means between schools.

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[1] Sidney L. Jackson, Catalog Use Study: Director's Report, ed. by Vaclav Mostecky (Chicago: American Library Association, 1958), p. 2.

Method of analysis and limitations.--The relationship between the various characteristics and performance was determined by computing some measure of association where applicable. For data given in interval measures, a Pearson product moment correlation (designated as r) was calculated.[2] The resulting correlation coefficients were tested for significance using a table of expected values.[3] For data which lent themselves to natural dichotomies (e.g., sex, instruction and work experience), a point biserial correlation coefficient was computed and tested for statistical significance using a *t*-test.[4] Finally, for a few of the characteristics, mean success scores were grouped and the differences between the means of these groups were tested for significance using analysis of variance.[5]

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[2] Allen L. Edwards, Statistical Methods for the Behavioral Sciences (New York: Holt, Rinehart and Winston, 1954), pp. 142-55.

[3] William H. Beyer, ed., CRC Handbook of Tables for Probability and Statistics (Cleveland: Chemical Rubber Co., 1966), p. 299.

It must be noted, however, that these analyses must be considered tentative at best. The purpose of the random selection procedure was to minimize response bias and to ensure the best chances for matching. The sample, however, cannot be considered--nor was it intended--to be a true probability sample of the undergraduate population at either school. Therefore, the analysis is appropriate to the participants only. Even so, this analysis is important if only as a preliminary investigation in determining any tendency of relationship between the numerous variables.

Exposure and familiarity.--A correlation coefficient was computed for each school for the variable "semesters in college" and "semesters on campus" in respect to the mean success score for each group of students. The computed correlation coefficients are given in Table 16. (For a summary of formulae used and the mean success scores for all students, see Appendices F and G.)

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[4] Helen M. Walker and Joseph Lev, *Statistical Inference* (New York: Henry Holt and Company, 1953), pp. 262-67.

[5] William L. Hays, *Statistics for Psychologists* (New York: Holt, Rinehart and Winston, 1963), pp. 356-458.

TABLE 16

CORRELATION COEFFICIENTS (r)

	Y-Variable Mean Success Score	
X-Variable	Wisconsin	Illinois
Semesters in college	.252	.125
Semesters on campus	.227	.162

The expected correlation coefficients for the Wisconsin group (N = 50) was .273 for the .05 level. For Illinois (N = 94), the value of "r" would be between .205 and .195. Therefore, none of the correlation coefficients is significant and the reverse relationship and apparent contradition between the two schools can be explained as chance occurrence.

While there was no significant difference when success scores were correlated with semesters on campus or in college, it was anticipated that there may be some significant difference between the means of the various classes. For the purpose of analysis, only the larger groups were considered--those second semester freshmen, sophomores, juniors and seniors who had indicated they had completed one, three, five, or seven semesters of college prior to the study. This resulted in deleting eight students at Illinois and six at Wisconsin who fell into intermediate categories. The means of the Illinois group appeared to support the general belief that semesters on campus was a better measure than semesters in college, as shown in Table 17.

TABLE 17

MEAN SCORES OF ILLINOIS STUDENTS GROUPED BY SEMESTERS IN COLLEGE AND SEMESTERS ON CAMPUS

	College		Campus	
Semesters	N	Mean	N	Mean
1	35	.396	40	.398
3	21	.425	24	.413
5	16	.411	11	.428
7	14	.477	11	.498

An analysis of variance yields a value for the F-statistic of 0.920 (semesters in college) and 1.202 (semesters on campus); neither of which is significant at the .05 level. The Wisconsin data, summarized in Table 18, did not show the pattern evident at Illinois. Similar analysis of the Wisconsin data also indicated no significant difference.

TABLE 18

MEAN SCORES OF WISCONSIN STUDENTS GROUPED BY SEMESTERS IN COLLEGE AND SEMESTERS ON CAMPUS

	College		Campus	
Semesters	N	Mean	N	Mean
1	15	.336	24	.337
3	5	.574	7	.583
5	17	.371	7	.400
7	7	.502	6	.460

The evidence of the experimental data indicates that there is no reason to consider either variable as superior.

In that case, the use of semesters on campus as the criterion for matching is as valid, but no better, as semesters in college.

The cumulative grade point average.--In a recent study conducted by Snider, grade point average was found to relate to test scores on a library ability test administered to college freshmen.[6] It was believed that a similar high correlation may exist between grade point average and the students' performance in searching for subject references. Correlation coefficients for the 94 Illinois participants and the 50 Wisconsin students were calculated. While the resulting correlation coefficient for Wisconsin students ($r = .125$) was not significant, the value for the Illinois group ($r = .219$) was significant at the .05 level.

This level of association accounts for only 4.8 percent of the total variance $[(.219)^2]$. In addition, the general relationship of grade point average to success score is not completely clear because of the non-significant results of the Wisconsin data analysis. Nevertheless, a review of the matched pairs was undertaken to determine to what degree differences in grade point average might have altered the matching. Although the original matching was done first on the criteria of semesters on campus and frequency of use of the catalog, close attention was paid to matching as many of the other characteristics as possible. As a result of this procedure it was found that 27 pairs had grade point averages which were within 0.4 points of each other, an additional three pairs were within 0.5 points, while only one pair had a difference of as much as one point.

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[6] Felix Eugene Snider, "The Relationships of Library Ability to Performance in College." (Unpublished Ph.D. dissertation, University of Illinois, 1965).

Frequency of use.--As mentioned, one of the two criteria originally selected for establishing matched pairs was the frequency of use of the main catalog. Students were asked to place themselves in one of six categories ranging from "less than once a semester" to "16 or more times a semester." In the anticipated analysis of the effect of frequency of use on the success score, it was believed that there would be some interaction between this criterion and semesters on campus (or class standing). Thus, it was considered possible that a freshman who used the catalog quite frequently might do as well as, or better than, a sophomore or junior who may seldom use the catalog.

Again, the limitation of the small sample size and the occasion in which just a few individuals represented the various combinations of use and semesters on campus, made it of questionable value to explore the potential relationship for all students. Instead, one of the larger groups of Illinois students was selected for analysis. Thus, for a fairly large group of participants (Illinois freshmen in this case), it was hypothesized that the mean success score for each of the six categories of frequency of use would be different and that the mean of the infrequent users would be lower than the mean of the next category. For the purposes of this analysis, freshmen were defined as those students who had been in college and on the Illinois campus for one semester.

The F-statistic computed by analysis of variance (F = 2.68) was significant at the .05 level. It must be noted, however, that the small number of participants in each category casts some suspicion on the results. Some evidence, however, to support the contention that the mean success score is associated with frequency of use and exposure to the catalog was available. When the scores for all students were grouped into the six categories without control for semesters on campus (or class standing), the resulting value of F (F = 0.50) was not significant. Table 19 is a summary of the group means by frequency of use for the two groups of Illinois students.

Other variables.--Other characteristics for which data were collected were thought not to be particularly important in the original matching process. These characteristics were: 1) sex, 2) type and amount of instruction, 3) work experience, and 4) approach. The reason for making this assumption varied according to the characteristic. During the pre-test

TABLE 19

GROUP MEANS FOR ILLINOIS STUDENTS BY "FREQUENCY OF USE" CATEGORY*

Frequency of Use	Freshmen N	Freshmen Mean	All Students N	All Students Mean
1	14	.352	28	.416
2	3	.244	22	.414
3	13	.455	27	.432
4	1	.734	11	.486
5	2	.312	4	.354
6	2	.458	2	.458

*For code used, see Table 8 (page 56).

phase, it was observed that the search procedures seemed to be unrelated to sex since there was a wide variation in success even though 23 of the 28 students were women. A similar absence of a specific pattern relating approach to successful searches was noted.

In regard to work experience and formal instruction in the use of libraries, it seemed most likely that the undergraduates selected would not have had much of either. In fact, of 94 Illinois participants, 60 had neither instruction nor work experience; 27 of 50 Wisconsin participants indicated neither work experience nor instruction. Table 20 is a summary of the responses to questions 12 and 13 of the General Information Form.

The amount of instruction in "how to use the library" must be considered minimal at best. At Illinois, ten students

TABLE 20

SUMMARY OF INSTRUCTION AND WORK EXPERIENCE AMONG BOTH GROUPS OF PARTICIPANTS

Library Experience	Illinois	Wisconsin
Neither instruction nor work experience	60 (63.8%)	27 (54%)
Instruction only	20 (21.3%)	15 (30%)
Work experience only	6 (6.4%)	6 (12%)
Both instruction and work experience	8 (8.5%)	2 (4%)

recorded that they had received such instruction as part of a general orientation program. Twenty-two students indicated that they had completed a series of library assignments as part of a course given in the Division of General Studies. Only one student indicated he had received instruction in a special course, part of the required work in a course in historiography. The total number of responses, 33, represents 28 students, some of whom had indicated more than one item. At Wisconsin, 13 responses were indicated under the category of "instruction as part of a general university orientation course," and four responses as part of the required assignment in a regular course (Freshman English).

The amount of work experience was also nominal. Most students indicated that their work experience consisted of general circulation and shelving assistance over a period of one year or less. The types of libraries represented in the

Illinois responses were: high school (eight students), academic (three), public (one) and elementary school libraries (three). Work in high school libraries was indicated by five Wisconsin students, three had experience in elementary school libraries and one in an academic library. Only one student at each school had worked in more than one type of library.

The three variables, sex, work experience, and instruction, lend themselves to natural dichotomies ("none" or "some" used for the latter two). The dichotomous measures can be used to compute another type of product moment correlation known as the point biserial correlation coefficient (r_{pb}). The calculated value in respect to mean success score for each characteristic is given in Table 21.

TABLE 21

POINT BISERIAL CORRELATION (r_{pb}) FOR SEX, INSTRUCTION AND WORK EXPERIENCE

	Students	
Characteristic	Wisconsin	Illinois
Sex	.1629	.1033
Instruction	.0036	.0004
Work Experience	.0758	.1119

Each value was tested for significance using a variant form of the _t_-test for difference between means and none was found to be significant. The experimental study data support the original assumption, therefore, that these measures need not be considered in the matching procedure.

Students were also requested to indicate the approach they most frequently used to search for material in the catalog. Each student indicated one of the following: 1) most frequently look for material by author or title; 2) most frequently look for material by topic (subject); or, 3) use the subject approach about as often as the author-title approach. Students were grouped by approach and a mean of the success scores was computed for each group. The means, shown in Table 22, were tested for difference by analysis of variance.

TABLE 22

GROUP MEANS BY APPROACH

	Illinois		Wisconsin	
Approach	N	Mean	N	Mean
Author-Title	26	.416	24	.433
Subject	38	.429	11	.415
Both	30	.432	15	.409

The F-statistic for the Wisconsin group, F = .052, and the value for the Illinois group, F = 0.070, were not significant.

Conclusions.--The analysis of the relationship between personal characteristics and mean success score for the study groups indicated no significant association except for grade point average. On the other hand, there was no evidence that the matching procedure followed was in any way invalid. Given a large sample from each institution, in fact, the simple procedure of random pairing without attention to these characteristics would have been appropriate.

The Validity of the Test Instrument

The question of validity inevitably arises when dealing with any instrument of measurement. The committees on test standards of the American Educational Research Association and the National Council on Measurements Used in Education have identified four types of validity.

> Content validity is concerned with the sampling of a specified universe of content.
>
> Concurrent validity is concerned with the relation of test scores to an accepted contemporary criterion of performance on the variable which the test is intended to measure.
>
> Predictive validity is concerned with the relation of test scores to measures on a criterion based on performance at some later time.
>
> Construct validity. More indirect validating procedures, which we refer to under the name construct validation, are invoked when the preceding three methods are insufficient to indicate the degree to which the test measures what it is intended to measure.[7]

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[7] American Educational Research Association and National Council on Measurements Used in Education, Technical Recommendations for Achievement Tests (Washington: National Education Association, 1955), p. 16.

The limitations of the present study, as well as the absence of a body of pertinent data from previous research, precludes the approach of concurrent or predictive validation. In addition, since what is measured is not a construct, the latter validation procedure is not applicable.[8] Some consideration, therefore, must be given to content validity.

The procedure for determining content validity is to compare the content of the test with the content of the universe to be measured. Within the objectives of the study and the nature of the hypothesis to be tested, the test instrument was developed to measure the ability of students to differentiate between subject and non-subject entries. The universe, therefore, consists of all the possible entries to be found in the catalogs being tested.

The degree to which the test represented the universe was affected by the considerations given to two other problems. First, it was deemed unreasonable to expect students to give more than one hour of their time to the study, thus limiting the number of problems that could be included. In addition, the variety of forms of subject headings was too great to allow representation of each type and required grouping them into more general categories. Hence, instead of considering some twelve forms as categorized by Eaton,[9] the more general forms "personal name entries," "corporate name entries," "criticisms" and "conventional subject headings" were used. The procedure described in Chapter II, including random selection of the initial group, was undertaken to ensure maximum content validity. Despite these efforts, and a limited degree of substantiation from observations of the responses of the participants, the assumption of validity relies heavily upon the judgment of the investigator.

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[8] Claire Selltiz, et al., Research Methods in Social Relations (Rev. one-vol. ed.; New York: Holt, Rinehart and Winston, 1959), p. 41.

One effort to determine the fairness, if not the validity, of the test exercises was undertaken. While the mean score of each question was expected to vary from school to school, it seemed reasonable to expect that the relative difficulty encountered in the eight problems would be the same for each group of students. Therefore, it was predicted that if each question was ordered by degree of difficulty as represented by the mean scores, the rank order would be the same for the Wisconsin group as for the Illinois group. Table 23 contains the mean score for each question as computed and the rank, in order of difficulty, for each group of students.

A Spearman-rho rank order correlation coefficient (r_s) was computed.[10] The calculated value, $r_s = .922$, was

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[9] Thelma Eaton, Cataloging and Classification: An Introductory Manual (3rd ed., Champaign, Ill.: Distributed by the Illini Union Bookstore, 1963), p. 131.

[10] Sidney Siegel, Nonparametric Statistics for the Behavioral Sciences (New York: McGraw-Hill Book Company, Inc., 1956), 202-13.

TABLE 23

MEAN AND RANK ORDER OF THE EIGHT TEST QUESTIONS

Question	Wisconsin Mean	Wisconsin Rank	Illinois Mean	Illinois Rank
Chemistry as a Profession	.020	1	.117	1
Statistical Design	.327	2	.356	3
Identification of Firearms	.640	7	.684	6.5
Amateur Athletic Union	.510	5	.543	5
Great Britain Board of Trade	.400	4	.128	2
Hebbel's "Agnes Bernauer"	.367	3	.370	4
Otto Ludwig	.624	6	.684	6.5
Jackson Pollock	.788	8	.861	8

significant at the .05 level. It was concluded that each question represented the same degree of difficulty, in comparison with the test as a whole, and was not biased in favor of one group or the other.

Furthermore, an analysis of the means within each group reveals that the differences between means is significant. This would support the original contention that search results are affected by the type of question--and the corresponding part of the catalog--being used. As additional support that the arrangement of the catalog did not affect the results of searching for subject references, the means for each question were compared between schools. Since it was suspected that the variances would be different, the _t_-test for difference between means without pooled variances was used.[11] The calculated values are given in Table 24.

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[11] Edwards, _op_. _cit_., pp. 273-74.

TABLE 24

TEST FOR SIGNIFICANT DIFFERENCE
BETWEEN MEANS FOR EACH QUESTION

Question	Mean Success Scores Wisconsin	Illinois	Calculated t-statistic
Chemistry as a Profession	.020	.117	2.506*
Statistical Design	.327	.356	0.355
Identification of Firearms	.640	.684	0.550
Amateur Athletic Union	.510	.543	0.386
Great Britain Board of Trade	.400	.128	3.607*
Hebbel's "Agnes Bernauer"	.367	.370	0.037
Otto Ludwig	.624	.684	1.045
Jackson Pollock	.788	.861	1.201

*Significant at the .05 level.

An approximation of the expected _t_-statistic was made and it was determined that for N = 50 (Wisconsin) and N = 94 (Illinois), _t_ would be expected to have a value greater than 1.986 and less than 2.008, depending on the variances for each set of means. Table 23 shows that for six of the eight questions arrangement does not, indeed, affect the resulting searches. The difference evident for the other two problems, creates some question about general applicability of this conclusion. Further analysis of the question-catalog interaction, therefore, was necessary and is described in the following chapter.

Summary

Mean success scores were calculated for the 31 pairs of students and used to test the hypothesis that dividing the catalog would increase effective use. From the evidence of the experimental groups, there was no reason to reject the null hypothesis. Assuming the validity of the appropriateness of the matching procedure, the divided catalog did not result in a more effective catalog for subject searches. An examination of the frequencies of successful location of cards for known-item searches also indicated no differences between the two groups. Therefore, it was determined that the arrangement of the catalog did not affect the results of subject or known-item searches.

The analysis of the relationship between personal characteristics and mean success scores for the study groups indicated no association except for grade point average (Illinois group only). On the other hand, there was no evidence that the matching procedure followed was in any way invalid.

A comparison of the responses to the eight-question test instrument indicated that the test represented similar problems and relative difficulty for each group. The mean success scores for each question among each group of students, in fact, indicated that there is a greater difference attributable to the question than to the arrangement of the catalog. An analysis of this interaction between difficulty and type of question seemed warranted and is undertaken in Chapter V.

CHAPTER V

DESCRIPTIVE ANALYSIS OF SEARCH PROCEDURES

In the preceding chapter, the analysis of the data was undertaken to test the hypothesis and to investigate the validity of some underlying assumptions. The results of this analysis indicated that arrangement did not significantly affect the successful retrieval of subject references. In addition, there was no direct evidence that the test results were related to any of a variety of participant attributes, except for grade point average for the Illinois group.

The testing procedure, however, indicated that the degree to which participants were successful in coping with the search requests varied from problem to problem. This difficulty could not be associated with the differences in the arrangement of the catalog alone, nor was the varying difficulty due to differences in the personal characteristics of the participants. The difficulties participants had in using the catalog might only be explained by an interaction of the question and the corresponding complexity of the catalog encountered. It is the purpose of this chapter to describe some observable search procedures. In doing so, it is the intention to show the causes of difficulty associated with the various problems as well as to indicate some general procedures common to many users.

Causes of Failure

During the data collection process, it was observed that a number of factors could be considered as the possible cause of failure or partial success. Four observable reasons were: 1) failure to select the appropriate search term, 2) the patron's inability to cope with alphabetizing (i.e., filing) regulations, 3) small peculiarities in the individual drawers at the two schools deemed unimportant in the original matching procedure, and 4) the inability of the patron to distinguish subject entries from non-subject entries. These four may not be the only sources of difficulty in using catalogs, but they do constitute general categories represented by observed procedures and patterns of searching. In those cases when the reason for failure was not clear, a fifth category was used in which the cause was indicated as "other reasons."

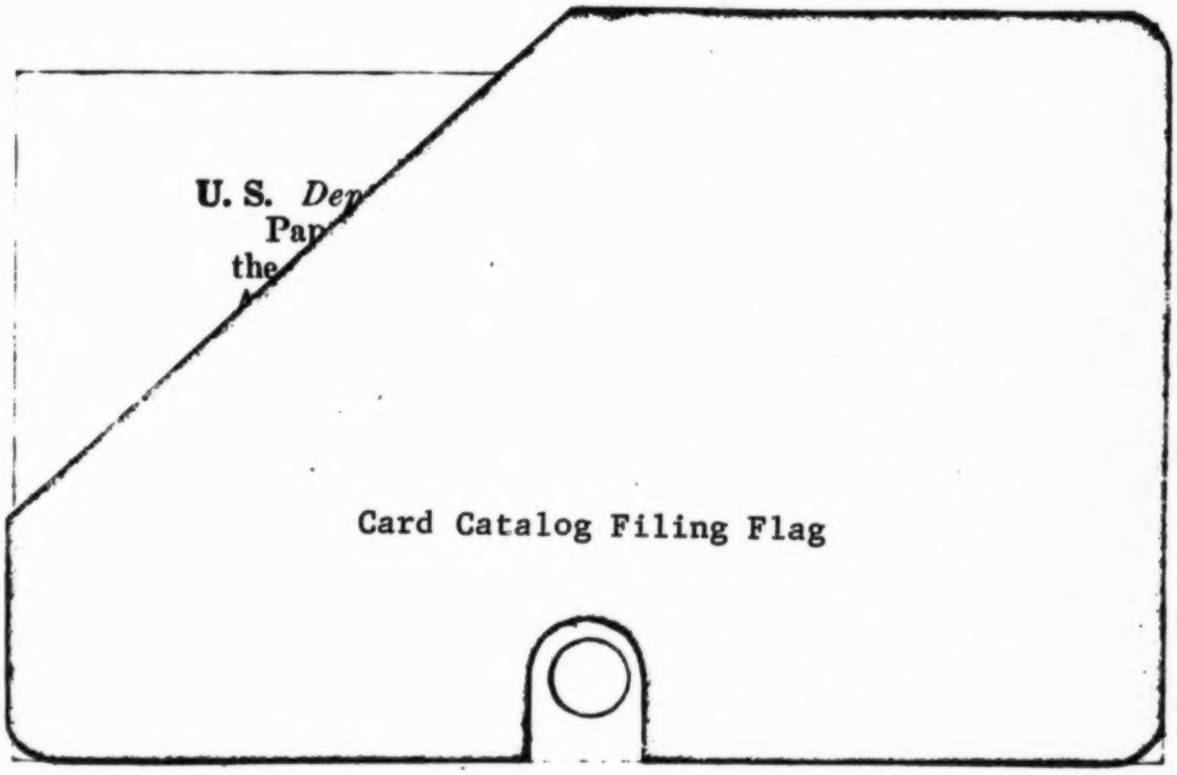
There were, however, certain decisions that had to be made in the assignment of the cause of failure in order to be consistent and to allow some comparability. For example, students searching for subject entries under the phrase heading "Chemistry as a Profession" frequently searched under the heading "Chemistry, Profession," "Chemistry--Profession" or "Profession(s)--Chemistry." This procedure was evident to the investigator but it was not inconceivable that the patron really began to search for "Chemistry as a Profession" and, having difficulty with the filing rules (subdivisions before phrases), ended up searching the subdivisions.

The question was whether this constituted selection of the wrong search term or difficulty with alphabetizing? Since such procedures were common to both groups, and since the search under the wrong term was obvious and the problem with the filing is speculative, the reason for failure was attributed to "selection of the wrong search term." While this may be considered a subjective judgment on the part of the investigator, every effort was made to remain consistent in the assignment of reasons for failure for all students.

A second problem involved the decision of what constituted the major, or primary, cause of failure. Illinois students who were searching for "Chemistry as a Profession," for example, frequently began looking under various subdivisions of "Chemistry." Frustrated in their efforts to locate an appropriate heading, many turned to searching under "Profession(s)." Quite often, students came across two title added entries which seemed appropriate: "The Profession of Chemistry." A few students went to the effort to inform the investigator that these were subject references even though such amplification had not been solicited. The decision, in this case, was that the first cause of difficulty was with the selection of the appropriate search term rather than confusion about what constituted a subject reference and nonsubject added entry.

The small peculiarities cited as one reason for failure were not considered important in the original matching of sections of the catalog. The introduction of filing flags (see Figure 2) at Wisconsin presented some difficulty to students. At Illinois, the use of temporary cards which were larger than the catalog cards--thus protruding above the regular cards--also caused some problems. Students (in the post-test interview) explained that these cards were some type of guide card which indicated the end of an appropriate section and the beginning of another.

FIGURE 2. FILING FLAG (Superimposed Over a Catalog Card) USED IN THE WISCONSIN CATALOG.



It was hypothesized that the reason division would produce more effective results in conducting a search for subject references was that the divided catalog made subject entries explicit. In the dictionary catalog, on the other hand, participants could be observed selecting title added entries and other non-subject added entries in the belief that these were subject references. The division of the catalog, however, does not completely alleviate this difficulty. It was assumed that there would be individuals who did not realize that the catalog was divided. For those who didn't, this represents as much of a misunderstanding about the differences between subjects and non-subject references as that faced by the user of the dictionary catalog. For the purposes of comparison, Wisconsin participants who used the author-title catalog for subject searches were equated to those who selected non-subject entries at Illinois.

In regard to this point, three interesting phenomena occurred at Wisconsin. First, some participants were completely unaware of the division of the catalog and had no success in locating any subject references. A second group of students "discovered" the subject catalog in the process of the exercises. For them, the test instrument was instructive. A third group seemed to move freely from one catalog to the other without ever realizing the difference. The investigator could only conclude that this was a matter of accident, depending on what part of the alphabet they encountered. Students would select a search term, walk down the center aisle separating the catalogs and then find the correct part of the alphabet. Whether this was in the author-title or subject catalog seemed to make no difference.

Tabulation of the causes of failure.--All responses were reexamined and a cause of failure assigned for each question. The causes were then coded as given in Table 25 and tabulated for each question. The results of this tabulation are given in Table 26 and 27.

TABLE 25

CODE USED FOR SUCCESS AND CAUSES OF FAILURE AND PARTIAL SUCCESS

Code	Explanation
S_0	Success; no difficulty.
F_1	Selection of wrong search term.
F_2	Difficulty with filing rules.
F_3	Peculiarities in the catalog.
F_4	Confused by non-subject entry.
F_5	Other; variables with question.

Inspection of the causes of failure or partial success indicate differences between schools greater than might be expected inasmuch as the mean scores for each question are so similar. Since Table 26 includes data for all participants it is possible that the differences noted might be due to differences in the personal attributes of the two groups. When

TABLE 26

FREQUENCY OF SUCCESS AND CAUSES FOR FAILURE OR PARTIAL SUCCESS BY QUESTION FOR ALL WISCONSIN (W) AND ILLINOIS (I) STUDENTS

Question	Students	S_0	F_1	F_2	F_3	F_4	F_5
Chemistry as a Profession	(W)	1	45	0	0	4	0
	(I)	11	82	1	0	0	0
Identification of Firearms	(W)	16	23	2	3	6	0
	(I)	33	14	47	0	0	0
Statistical Design	(W)	32	10	0	0	6	2
	(I)	26	3	1	0	40	24
Amateur Athletic Union	(W)	25	19	3	0	3	0
	(I)	48	26	0	0	18	2
Gt. Brit. Board of Trade	(W)	20	15	10	0	5	0
	(I)	10	38	23	3	20	0
Hebbel's "Agnes Bernauer"	(W)	18	8	0	0	22	2
	(I)	26	51	0	0	17	0
Otto Ludwig	(W)	2	0	0	10	38	0
	(I)	12	0	0	1	81	0
Jackson Pollock	(W)	38	0	3	0	7	2
	(I)	61	0	0	0	0	33
Total:	(W)	152	120	18	13	91	6
	(I)	227	214	72	4	176	59

TABLE 27

PERCENT OF SUCCESS AND CAUSES FOR FAILURE OR PARTIAL SUCCESS BY QUESTION FOR ALL WISCONSIN (W) AND ILLINOIS (I) STUDENTS*

Question	Students	S_0	F_1	F_2	F_3	F_4	F_5
Chemistry as a Profession	(W)	2.0	90.0	0.0	0.0	8.0	0.0
	(I)	11.7	87.2	1.1	0.0	0.0	0.0
Identification of Firearms	(W)	32.0	46.0	4.0	6.0	12.0	0.0
	(I)	35.1	14.9	50.0	0.0	0.0	0.0
Statistical Design	(W)	64.0	20.0	0.0	0.0	12.0	4.0
	(I)	27.7	3.2	1.1	0.0	42.5	25.5
Amateur Athletic Union	(W)	50.0	38.0	6.0	0.0	6.0	0.0
	(I)	51.1	27.6	0.0	0.0	19.2	2.1
Gt. Brit. Board of Trade	(W)	40.0	30.0	20.0	0.0	10.0	0.0
	(I)	10.6	40.5	24.5	3.2	21.2	0.0
Hebbel's "Agnes Bernauer"	(W)	36.0	16.0	0.0	0.0	44.0	4.0
	(I)	27.6	54.3	0.0	0.0	18.1	0.0
Otto Ludwig	(W)	4.0	0.0	0.0	20.0	76.0	0.0
	(I)	12.8	0.0	0.0	1.1	86.2	0.0
Jackson Pollock	(W)	76.0	0.0	6.0	0.0	14.0	4.0
	(I)	65.0	0.0	0.0	0.0	0.0	35.0
Total:	(W)	38.0	30.0	4.5	3.2	22.8	1.5
	(I)	30.2	28.3	9.6	0.5	23.4	7.8

*The percentage shown is the frequency in each cell divided by the total number of searches for each row. The sum of each row is 100 percent (variation is due to rounding).

only the 31 matched pairs are considered, however, similar discrepancies were evident. Therefore, a closer analysis of the search patterns and difficulties encountered is warranted.

Analysis of the Cause of Failure

Peculiarities in each catalog (F_3).--Of the five categories enumerated as causes of failure, the small peculiarities within each catalog accounted for the smallest number of failures or partial successes. Of the 17 cases in which filing flags or temporary catalog cards presented some difficulty, over one-half of these problems were associated with the Wisconsin students' searches for material about (rather than by) Otto Ludwig.

File flags were located in two places in the Ludwig file which had a direct effect on the search for appropriate cards. One flag was located between the fifth and sixth entry and the second was found between the last and second last cards. Four students indicated the file ended at the first flag. Some students searched the entire file including the criticisms of Ludwig's works. Among this group, a few recognized the difference between biographical and critical works and, in returning to the appropriate file, inadvertantly neglected to include the last card. Thus six participants indicated 28 of 29 appropriate cards, kept from a perfect response by the appearance of a filing flag. In general, however, such difficulties constituted slightly more than 2 percent of all failures or partial successes and appear insignificant in comparison to other difficulties. At the same time, it illustrates that those catalog characteristics which had appeared inconsequential did prove to be a source of difficulty to a small number of patrons.

Other problems (F_5).--Some problems, noted as "F_5," also were minor except in two cases. There were a few students who searched under such headings as "Ameteur," "Hebel" and "Habbel" even though the correct spelling was provided. More important, however, was the consistent difficulty that occurred in respect to the questions about Jackson Pollock and "Statistical Design."

The Pollock files were identical in size (three cards) and in type (all subject added entries). For some reason, 33 Illinois students (and two at Wisconsin) selected only two of the three cards as appropriate. The only possible difference that could be observed in all cases was that the selected cards had personal names as the main entry while the third card was a corporate main entry. Some supporting evidence that this may, indeed, have been the reason for such a decision can be advanced on the basis of observed procedures in connection with other questions.

Many students, for example, could not conceive of corporate bodies as "authors" and this was exemplified by the difficulty students had with the questions dealing with corporate entries as subjects. In many cases, the corporate main entry (in the Pollock file) was identified as the "publisher." In the search for other biographical material (Ludwig), students also identified the appropriate cards by the fact that a second personal name appeared under the name of the person about whom they were seeking information. The fact that the searches were made in the subject catalog at Wisconsin, or contained "red headings" at Illinois, was not sufficient to overcome some notions individuals had about corporate entries.

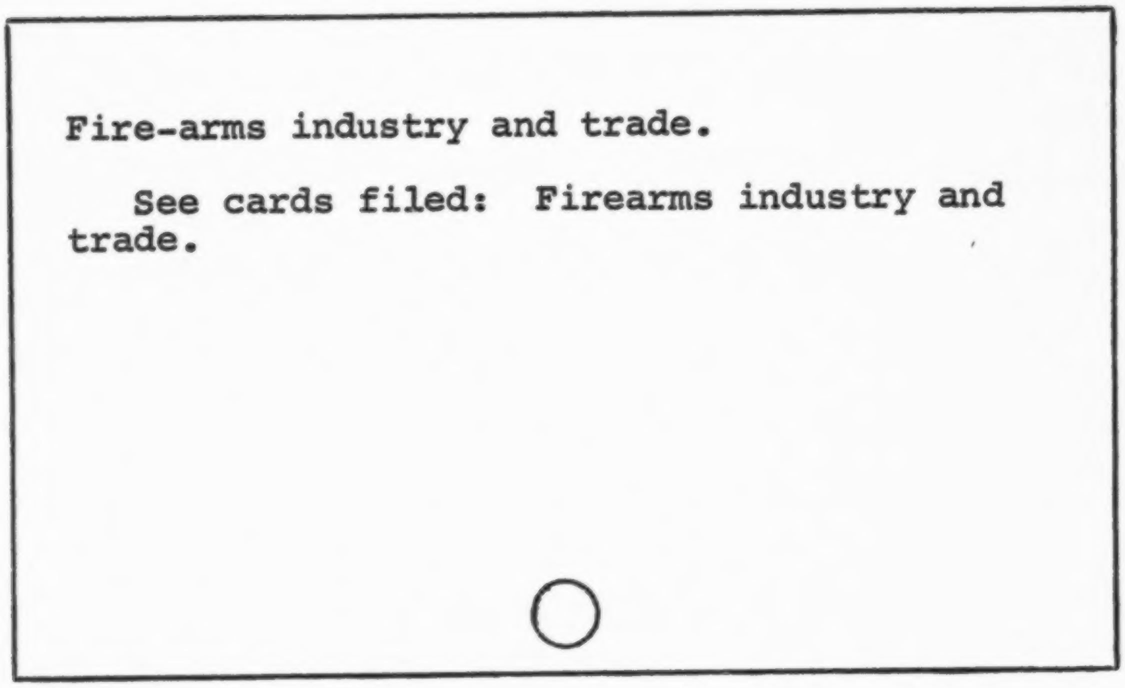
The search for material on "Statistical Design" provided evidence of the varied meaning associated with cross references. Students who searched for the unused term "Statistical Design" found a cross reference to the used term "Experimental Design." This "see" reference was interpreted as having the same meaning as a "see also" reference by 24 Illinois students and two Wisconsin students. Thus, the Illinois students selected the two title added entries appearing after the cross reference as appropriate and preferred to consider the entries under "Experimental Design" (which were not searched) as a last alternative. The two Wisconsin students decided that nothing on the subject was available.

Perhaps more enlightening was the decision of many of the students that they would (and did) search the "Experimental Design" file but that they would normally--that is when conducting a search for one's own need--select only those titles that expressly mentioned "statistics" and would exclude the others. There was little question that these students (at Illinois and Wisconsin) did not consider the two terms as synonymous but rather as a reference from a specific term to a more general, inclusive term.

Difficulty with filing rules (F_2).--Two of the eight questions revealed that the responses were affected by various complexities of the filing rules used in library catalogs. A comparison, between schools, of the responses to the "Identification of Firearms" question, indicated a great discrepancy in the number of successful searches. This was directly attributable to difficulty with the alphabetical arrangement. Both catalogs treat the term "Firearms" as a single word and file such entries after headings in which "fire" is the first of one or more terms (e.g., Fire, Fire alarms, Fire-worshipers, etc.).

The basic difficulty was that students did not realize that they were searching under the term as if it were two words "Fire Arms." Most students continued to search through the file and at Wisconsin they frequently discovered the correct entry (but not, necessarily, the correct subdivision). At Illinois those who continued scanning the file encountered a reference card as shown in Figure 3. To all but three of the students this cross reference was meaningless. Indeed, of the two Illinois students who searched under the exact

FIGURE 3. "FIREARMS" REFERENCE CARD
LOCATED IN THE ILLINOIS CATALOG



Fire-arms industry and trade.

See cards filed: Firearms industry and trade.

heading "Identification of Firearms" and found the cross reference to "Firearms--Identification," one had already encountered the "Fire-arms" cross reference and decided it would be futile to return to the "Firearms" drawer. (The second student began in the "Identification" section and had no difficulty in reaching the appropriate section.)

The second question which was affected by the filing rules was the search for material about (but not by) the Great Britain Board of Trade. Twenty percent of the Wisconsin students had difficulty in coping with the rules for filing as compared to 23 percent of the Illinois students. Unlike the "Firearms" search, the difference in the successful location of the appropriate cards (40 percent at Wisconsin and 11 percent at Illinois) would seem to be due to other factors. It was interesting to note the difference in the way students approached the problem in comparison to the U.S. Civil Service Commission--not included in the final analysis.

As noted in Chapter III (pages 60 and 61), the number of students who had difficulty in coping with the alphabetical arrangement at Illinois and Wisconsin varied in respect to these two questions. It seems plausible that one reason is that students, from previous experience, have become conditioned to the apparent difficulty of using the "U.S." files but do not have a similar reservation about headings for other countries--perhaps expecting the files to be smaller. Again, the nature of the test instrument prevented gathering conclusive evidence for this hypothesis, but a comparison of the three corporate entries reveals that the rate of success was inverse to the file size and that the single most important factor associated with failure was selection of the wrong search term.

The use of incorrect search terms (F_1).--The largest single cause associated with complete failure in locating appropriate cards for any request was the selection of incorrect search terms. In an attempt to minimize this difficulty, the questions submitted to the students were in terms that appeared in the catalog. In some cases, these were unused terms for which a cross reference was provided. Nevertheless, of the 1,152 searches included in this analysis, 334 (29 percent) were conducted using the wrong term or terms.

For most questions, the headings selected were more general than the request itself. In addition, many of the searches were conducted using key concepts contained in the request, frequently inverted. For the corporate entries, the most frequently used headings were "Civil Service--U.S.," "Boards of Trade--Great Britain," and "Athletics." The most popular (but incorrect) terms used in connection with conventional subject headings were "Chemistry--Profession," "Profession--Chemistry," "Design--Statistical," and "Firearms."

In contrast to this difficulty in selecting the appropriate term, searches for material about individuals presented no problem in either catalog. More serious difficulty was associated with the request for material about Hebbel's "Agnes Bernauer." A fairly large number of Illinois students (54 percent) actually chose to look for criticisms under the title of the work "Agnes Bernauer" or in the more conventional form (for a person) under "Bernauer, Agnes." A much smaller number of Wisconsin students (16 percent) used these approaches.

Associated with the search procedure using incorrect terms for corporate entries was an unusual pattern in making the final decision of which cards were pertinent to the request. A number of students indicated that the appropriate cards were contained within the general files located (for example, "Civil Service--U.S.") without further explanation. Among those students who did not select the complete file as appropriate, there were many who indicated entries for which the main entry was the corporate body given in the request. Some effort was made, during the post-test interview, to ascertain the logic behind this latter procedure. Some students responded that material "published" by the agency should contain some information about the agency. From others, there were vague expressions that the cards selected seemed to be the most logical ones in the file.

Inability to distinguish between subject and nonsubject entries (F_4).--The major hypothesis of this study was directly concerned with this category of difficulty. The fact that 23 percent of the students had difficulty in distinguishing between the two types of entries makes this the second largest contributor to failure or partial success in making subject searches. Yet for three questions, "Chemistry as a Profession," "Identification of Firearms," and "Jackson Pollock" this difficulty was observed only among the users of the divided catalog. In addition, the use of the inappropriate author-title catalog in the search for criticisms occurred more frequently than the selection of non-subject entries by the users of the dictionary catalog. On the other hand, confusing non-subject entries for subject references was more common among the users of the dictionary catalog in coping with the other four questions than among the divided catalog users. The chief example of the nature of this problem was seen in connection with the searches for material about "Statistical Design."

A number of Illinois participants (42 percent) included title added entries as well as subject entries for the "Statistical Design" question. This did not include the 24 percent who had selected only the two titles filed after the cross reference referring to the used term "Experimental Design." The ten titles most frequently cited were considered to be--by the participant--more specific subdivisions of the general subject being searched.

Not all the confusion, however, was centered around that of subject versus non-subject entries. For the Ludwig search, students had difficulty in distinguishing between subject added entries (i.e., biographical material) and author-title subject added entries (i.e., criticisms). While this may seem a highly technical point, the difficulty students had with the Hebbel criticism would indicate that there is a minimum of understanding of the fine distinction between the two types of entries.

The implications of these observations, not only in respect to the research design, but to improving the use of library catalogs, is discussed as part of the general summary and conclusions in Chapter VI.

Summary

The purpose of this chapter was to investigate the nature of the relationship between the various questions and the difficulties encountered in each catalog. The results of this analysis can be summarized in respect to two general elements of the study.

First, the question-catalog interaction, which was assumed and was the basis for constructing a multi-exercise test instrument, was substantiated. Second, the general conclusion that arrangement does not significantly affect the successful retrieval of subject references is tenable. It was observed that for any possible benefit attributable to divided catalogs (for example, a larger percent of successful searches for "Statistical Design") there may be a corresponding disadvantage (re: "Chemistry as a Profession").

These conclusions, however, are appropriate only to the two groups participating in the study and for the specific questions used. Generalization to undergraduates in large universities and to all types of subject searches can be made only if the samples used in this study can be deemed representative.

CHAPTER VI

SUMMARY AND CONCLUSIONS

The purpose of this study was to investigate the proposal, set forth by a number of librarians at various times during the past thirty years, that dividing a library catalog would result in improved effective use of the catalog. The design of the study undertaken to test this hypothesis required the resolution of a number of problems.

Review of the Procedure

The study was developed in terms of the variables pertinent to a catalog search--the question, the catalog and the user. To test the hypothesis, the same search should be made by the same patron in catalogs alike in all respects but arrangement. Practical limitations necessitated certain changes in this theoretical design.

A set of search-questions was developed as the data collection instrument. The questions were obtained by random selection of personal and corporate entries from the dictionary catalog that had been selected for use in the study. In addition, a number of conventional subject headings were selected randomly from a standard list of subject headings. The final test instrument also included two known-item search requests.

Two catalogs--one in dictionary arrangement (Illinois), the other divided into subject and non-subject entries (Wisconsin)--were selected and the appropriate sections verified in regard to similarity in size and complexity. The testing was conducted during the spring semester of 1966-67 with undergraduates from the two universities whose catalogs had been chosen.

Elements of the Design

The causal element.--A number of reasons have been enumerated to explain the difficulties encountered by catalog users. These reasons include the selection of the wrong search term, problems with the filing of catalog entries, and failure to understand or interpret correctly the meaning of "see also" references. None of these difficulties, however, can be alleviated by dividing the catalog. In fact, during this study all of these causes of failure were observed among the users of both types of catalogs. In addition, both groups of students demonstrated that as much confusion exists about the meaning of "see" references as had been observed about "see also" references in previous studies.

These studies have also indicated that confusion of title entries for subject headings by patrons caused difficulties in the use of the catalog. The divided catalog, by providing a separate file for subject entries, makes the subject approach more explicit. It was believed, therefore, that the number of non-subject references that would be included in subject searches among catalog users would be decreased among the divided catalog users thereby producing an increase in the effective use of the catalog.

Defining effective use.--Measuring effective use was one of the important questions that had to be considered. A review of previous catalog use studies revealed not only a series of shortcomings in design for testing the effectiveness of the catalog, but a relatively weak definition of effective use. The method of measuring effectiveness--and thereby inferring a definition of effective use--was essentially that of determining how frequently the patron was satisfied in his search for some material. This definition requires the acceptance of two underlying assumptions of questionable validity. First, it is assumed that the results of a single subject search represent the average ability of an individual. A series of such searches was then used to infer the effectiveness of the catalog. This does not, however, guarantee that all types of questions have been asked nor does it account for the possible difficulty that one patron may have when searching for another subject and encountering a more complex part of the catalog.

For this study, each participant was requested to complete a series of catalog searches. As a result of this procedure, it was clearly demonstrated that the nature of the question and the complexity of the catalog were as important in determining effective use as was the ability of the participant.

A second assumption of the definition of effectiveness in previous studies was that the material located was more relevant to the participant's need than some other reference. The concept of relevancy is not a simple problem to resolve. What may be a relevant document for one individual may be irrelevant for a second, even though they both may have selected the same index term to make the search. The process of deciding what document is relevant to a need can only be made by the user. The user, however, cannot exercise his maximum option of choice unless he has located all pertinent references.

It was upon this concept that the decision was made to test the students' ability to locate pertinent references but not to ask for a judgment of the appropriateness of the document.

Scoring the results.--Given the definition of effective use--i.e., the location of all pertinent subject references--a measure designated the "mean success score" was developed. This measure provided for crediting the searcher for locating pertinent references and penalizing him for including inappropriate references. The meaningfulness of this score, for testing the hypothesis, was based on an important assumption. It was assumed that any differences in the scores would be due to the hypothesized causal element (i.e., confusing non-subject entries for subject entries) and that other reasons for failure would be relatively consistent.

The analysis described in Chapter V, however, provided some evidence that cast doubt on the validity of this assumption. It was found that some differences in the mean success score were due to types of difficulties other than the inability to distinguish subject entries from non-subject entries. A question-by-question analysis illustrated that the causes of failure were not consistent for each question either between catalogs or for any one single catalog. Therefore, while the mean success score does indicate how well an individual has performed--in terms of the definition of effective use--it does not tell what was the cause of difficulty.

The matching procedure.--Another assumption, upon which the validity of the investigative procedure was based, concerned the appropriateness of the two criteria selected for the initial matching of the respondents. An analysis of these two criteria--exposure and familiarity--as well as other characteristics of the participants was undertaken. Data on the following attributes were collected: 1) semesters on campus and class standing, as measures of exposure to the catalog; 2) frequency of use of the main catalog as a measure of familiarity; 3) sex; 4) cumulative grade point average; 5) most common approach to using the catalog; 6) the type and amount of instruction received in "how to use the library"; and 7) work experience in libraries.

The analysis of the relationship between personal characteristics and mean success score for the study groups indicated the absence of any association except between grade point average and mean success score. Based on this series of analyses it was determined that the matching procedure followed was appropriate. This conclusion, however, is not intended to imply that these characteristics are not related to the ability to use catalogs effectively. For a relatively homogeneous group, given a similar educational level--such as university undergraduates--the range of differences in the various characteristics considered is so narrow that matching on additional criteria would seem unwarranted.

General Findings

The specific hypothesis tested was:

> Assuming all other factors are equal, subject searches through a catalog in which the subject entries have been separated (e.g., a divided catalog) will produce more pertinent references and fewer inappropriate references than identical searches using a file combining all entries into a single (dictionary) sequence.

Effective use of the catalog was measured in terms of a mean success score for subject searches. This score represented the ability of students to select appropriate subject references in response to a series of questions. The experimentally derived data were tested for significance using a t-test for difference between means. The means were found not to be different and it was concluded that dividing the catalog was not a satisfactory device for making subject searches more effective.

An analysis of the difficulties students had in coping with various questions was undertaken to determine if such difficulties were associated with arrangement. The results of this analysis indicated that for any potential benefits attributable to the divided catalog (i.e., a larger percentage of successful searches for one or more questions) there were corresponding disadvantages (i.e., lower rates of success for other questions). Furthermore, the percent of failures attributed to the causal element was almost as great for the users of the divided catalog (22.8 percent) as for the users of the dictionary catalog (23.4 percent). It was concluded, therefore, that for the two groups in general, the divided catalog did not facilitate subject searches more than the dictionary catalog.

The effect of arrangement on known-item searches was also investigated. Students were requested to determine if their respective library contained two specific documents. An analysis of the responses indicated that the rate of success or failure in obtaining the call number for the two documents was not related to the differences in the arrangement of the two catalogs.

Conclusion.--As a result of this study, it was concluded that for a series of questions representing different levels of difficulty and for a fairly limited range of catalog use habits and ability, changes in the arrangement of large catalogs would not result in more effective use. At the same time there was no overwhelming evidence obtained in this study to indicate that one type of catalog was distinctly superior to the other.

Implication.--Subject to the limitations described below, this study presents some data to assist the academic librarian in making a decision about the arrangement of the catalog. The decision may be made in terms of cost of production and maintenance with some degree of confidence that the choice of arrangement will not affect the use of the catalog by the undergraduates of the institution.

Limitations of the Findings

Every study has inherent limits--both conceptual and practical--which define the degree of generalization that is possible. In the interest of maintaining maximum control over the various elements of catalog searches, the choice of participants, catalogs, and questions was highly structured. This imposes a fairly severe limitation to the generalization of the findings to non-participants. On the other hand, some inferences to other groups may be made, given the acceptability of some assumptions.

Previous research has indicated that subject searches constitute approximately half of the use made of catalogs.[1] Since it was contemplated that changes in arrangement would not affect the results of known-item searches--substantiated in this study--it was natural to emphasize the subject approach. Another generalization from previous studies can also be considered.

There is some evidence to indicate that educational level is associated with successful use of catalogs.[2] Difficulties encountered by undergraduates might be assumed to be common to users with less educational preparation. No inferences can be made to those who represent a higher level on the educational continuum. There is some evidence, however, to indicate that many individuals who are representative of this upper level (i.e., graduate students) do not use the catalog for subject searches as frequently as for known-item searches.[3] Therefore, exclusion of this latter group is not as serious as it may appear at first.

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[1] Carlyle J. Frarey, "Studies of Use of the Subject Catalog: Summary and Evaluation," in Maurice F. Tauber, ed., The Subject Analysis of Library Materials (New York: School of Library Service, Columbia University, 1953), p. 162.

[2] *Ibid.*, p. 155.

No single study can provide conclusive evidence in support of a single hypothesis. The conclusions reached in this study are subject to a type II error (that is, a true hypothesis has been rejected). One way to decrease the probability of making such an error, and thereby increase the power of the test, is to increase the size of the sample. In addition, even if the groups selected for participation in the study are truly representative of academic library users (which is not contended), there is little basis for making inferences to groups with other characteristics. It may be, for example, that for large urban public libraries with their variety of users, dividing the catalog would increase effective use.

Suggestions for Further Research

At least three different approaches can be explored further in an attempt to improve catalog use. First, more and better instruction of all potential users of the catalog might be undertaken. Second, continued efforts in the improvement of the catalog through changes in form, format and arrangement might be investigated. Third, a radical departure from the traditional concept of a public catalog and more direct professional service to patrons may be attempted.

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[3] Margaret Cornelia Brown, "The Use of the Subject Catalog by Graduate Students in the Social Sciences." (Unpublished Master's thesis, Graduate Library School, University of Chicago, 1946), p. 53.

Improved instruction.--It was noted previously (Chapter I, p. 11) that giving more and better instruction to catalog users may be a difficult, perhaps unrealistic goal. There is, at the present, no conclusive evidence that would help to establish the appropriate level of knowledge and familiarity that such instruction must attempt to reach. It may be fruitful to evaluate the increase in effective use among those who have had a one semester course in "how to use the library." Representatives from such a group were not included in the Illinois sample used in this study although a one semester course is offered to undergraduates by the Graduate School of Library Science. The evidence gathered in this study, however, indicates that a few hours of formal or informal instruction does not have an apparent influence on the ability of undergraduates to use the catalog. These findings cannot be considered conclusive because of the sampling procedure used, and are also subject to verification.

Improving the catalog.--Improvement in the catalog itself would appear to be a more fruitful approach to increasing effective use. It was within this context that the present study was undertaken. While the crisis-like atmosphere associated with the information "explosion" and the need for bibliographic control has given impetus to studies dealing with the problems of bibliographic entry and subject analysis, there are indications that failure to consider the problems of form, format, and arrangement may have serious consequences.

Writing on the economics of book catalog production, Hayes, Shoffner, and Weber indicate that judgments to be made in selecting the form and content of a book catalog are hindered by the paucity of serious studies in this area:

> The human engineering of the book catalog divides into three major aspects, each of which deserves further study. One is the design of the bibliographical entry, treatment of cross references, formatting of the secondary entry, and syndetic relationship to supplements and indexes. The second is the formatting for ease of scanning. . . . The third aspect is the packaging for ease in handling . . .[4]

In contrast, Lancaster and Mills, in writing about the Cranfield Project, dismiss the effect of display (i.e., file organization) as an important factor in determining operating efficiency of a retrieval system.[5] The limitation of this conclusion, as Swanson has pointed out, is that the indexers also conducted the searches and the indexer's memory may have been the reason for results that showed no difference in retrieval between the four systems of indexing tested.[6] Even if memory is not an important factor, it is important to point out that the individuals had expertise in the intricacies of bibliographic organization, an assumption that cannot be inferred to a more general population represented by the lay catalog user.

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[4] Robert M. Hayes, Ralph M. Shoffner, and David C. Weber, "The Economics of Book Catalog Production," Library Resources and Technical Services, 10 (Winter, 1966), 65-66.

[5] F. W. Lancaster and J. Mills, "Testing Indexes and Index Language Devices: The ASLIB Cranfield Project," American Documentation, 15 (January 1964), 4-13.

[6] Don R. Swanson, "The Evidence Underlying the Cranfield Results," Library Quarterly, 35 (January 1965), 11.

There is an almost inexhaustible number of changes and improvements that may be proposed for the catalog. For example, with the proliferation of book catalogs in recent years, it is important to determine whether book catalogs actually are an improvement in terms of effective use or whether their advantages and disadvantages are limited to the economics of production and maintenance.

Perhaps a more promising development, which has implications for all types of catalogs regardless of form, would be the establishment of classified catalogs as replacements to the more traditional dictionary (and divided) catalogs. McGeever's study[7] provided some information about the users of one specific classified catalog, but little is known about the effectiveness of the classified catalog.

The traditional unit card, as exemplified by printed Library of Congress cards, is also subject to criticism. There is, certainly, a need to determine if more information might not be conveyed (and more accurately) if changes in the formatting of the unit card were made. There are, of course, a number of changes that have been suggested which range from photoduplication of the title page, advocated almost 90 years ago,[8] to Voos' more recent proposal of a vertically-divided card.[9]

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[7] Emmett Bernard McGeever, "A Study of Use of a Classified Catalog." (Unpublished Master's thesis, Graduate Library School, University of Chicago, 1958), pp. 2-3.

Finally, numerous studies have indicated that patrons do not completely understand the meaning of various types of cross references. Mostecky has suggested a rather elaborate revision of such cards to indicate the relationship of various subject headings to more specific terms and to broader terms as well as to other related subjects.[10] In contrast, the simple process of changing the words "see" and "see also" to more precise terminology (such as the "refer to" used in some thesauri of descriptors) may be sufficient. While these two recommendations may represent the extremes in suggested changes, the obvious need for improvement of cross references in library catalogs is well documented.

Professional servicing of the subject catalog.--Perhaps the third suggestion for improvement in the use of catalogs represents the furthest departure from traditional concepts.

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[8] Henry Stevens, "Photo-bibliography; Or, A Central Bibliographical Clearing-House," in Edward B. Nicholson and Henry R. Tedder, eds., Transactions and Proceedings of the Conference of Librarians Held in London October, 1877 (London: Printed at the Chiswick Press by Charles Whittingham, 1878), pp. 70-80.

[9] Henry Voos, "Revision of the Current Library of Congress Card Format," Library Resources and Technical Services, 11 (Spring 1967), 167-72.

[10] Vaclav Mostecky, "Study of the See-Also Reference Structure in Relation to the Subject of International Law," American Documentation, 7 (October 1956), 294-314.

The catalog is not a simple bibliographical tool to understand and use. The ability to recognize subject headings, for example, is a fairly elementary concept. Yet for many users this may represent a rather sophisticated idea. If this is true there is a wealth of information the lay user does not use, e.g., tracings, notes on cards, the classification number and cross references to related subjects.

If it is acceptable to provide professional assistance to users of other types of bibliographies and indexes (e.g., periodical indexes, special subject bibliographies, etc.) it would seem logical to include the subject analysis of the library collection which the subject catalog represents within this area of responsibility. The proposal, then, is to make the subject portion of the catalog a part of the reference-bibliography service of the library and not to treat it as a separate entity in itself. As with other reference tools, the individual who begins to feel competent in the use of the subject index through continual assistance will also begin to make more and more independent searches. At the same time, the availability of professional assistance will be explicitly clear and not implied as is so often the present case in many libraries.

The proliferation of separate undergraduate libraries on major university campuses would seem to afford an ideal situation to test the practical application of this approach.

The suggestion that subject catalogs be dispensed with completely may seem to be a drastic solution. On the other hand, a continuation of the policy of expecting the lay catalog user to become competent enough to use the catalog at its maximum potential may be as drastic, and unrealistic, as well.

In the development of the problem dealt with in this study the original thesis was that professional librarians had one of two choices for increasing the usefulness of the library catalog. The first was to provide more and better instruction for users of library catalogs. In addition to the limitations of such an approach, which were discussed earlier, it seems clear that education of patrons requires dealing with an element of the problem over which the professional librarian has little control. The alternative was to consider what efforts might be undertaken to improve the product itself (the catalog) and thereby indirectly influencing the patron's ability to use the catalog. While this second approach remains tenable and subject to further study, it is apparent that the amount of change that must take place may be very extensive.

As a result of this study, which afforded the opportunity to observe closely almost 200 students in a relatively short period of time, another concept was developed. The individual student's approach was mentally compared with what might be expected of librarians attempting the same search. Through a process, yet unclear, of educational preparation and experience, a librarian develops the ability to approach a problem by considering and using a wide range of alternatives. These include the choices between different entries and forms of subject headings (filing differences), alternatives suggested by tracings, etc. Students in this study, while exhibiting some flexibility, performed each catalog search in a fairly narrow, and frequently predictable, fashion. The approach suggested--professional servicing of the catalog--would seem to offer greater possibilities for securing information about the user and the adequacy of the catalog than any other method of research yet undertaken.

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APPENDIX A

FORMS USED IN PRE-TEST PHASE

LIBRARY RESEARCH CENTER
428 LIBRARY

L.S. 255 CATALOG USE EXERCISE

PURPOSE

The intent of this study is to secure "normal" scores for an exercise which is being developed to measure the effective use of a large university library catalog. The results of this exercise will in no way affect your grades in the course nor will there be a similar exercise given at the end of the semester. The general results, however, will be used to determine whether certain areas of the L.S. 255 curriculum may need further emphasis during the remainder of the semester as well as for future L.S. 255 classes.

PROCEDURE

1. Sign up for a one-hour period on the sheets posted on the bulletin board located outside of Room 314. Please allow a full hour for this exercise; do not schedule your hour immediately before another class.

2. Report to Room 422 at the time you have selected to participate. The room is located in the library on the 4th floor just above Room 314 and can be reached most easily by using the North stairway.

3. You will be asked to complete a brief "Information Sheet." All information provided will be kept confidential and will be used only to make some statistical tests.

4. The catalog use exercise will be completed at the main catalog of the University library (2nd floor) in the presence of the assistant.

James Krikelas
Research Associate

APPENDIX A (contd.)

LIBRARY RESEARCH CENTER
UNIVERSITY OF ILLINOIS

GENERAL INFORMATION SHEET
(Confidential)

SEARCH NO. ________

I. PERSONAL AND EDUCATIONAL INFORMATION

Sex: ( ) Female ( ) Male

Age: ________

Official Class designation:

( ) Freshman	( ) Junior	( ) Master's Program
( ) Sophomore	( ) Senior	( ) Doctoral Program

Is this your first semester in attendance at this university: ( ) No ( ) Yes

Undergraduate subject field:

Major: ________________________________

Minor (if any): ________________________

II. LIBRARY EXPERIENCE

A. How frequently have you used the main public card catalog in the central library?

( ) Less than once a semester
( ) 1 or 2 times a semester
( ) 3 or 5 times a semester
( ) 6 to 10 times a semester
( ) 11 to 15 times a semester
( ) 16 or more times a semester

APPENDIX A (contd.)

II. LIBRARY EXPERIENCE (contd.)

B. In the use of the card catalog do you

( ) most frequently look for material by author or title?
( ) most frequently look for material by topic (subject)?
( ) use the subject approach about as often as the author-title approach.

C. Have you ever received instruction in "how to use the library" in one or more of the following:

1. as part of a general university orientation course?

   ( ) No

   ( ) Yes. If yes, at what institution? __________

2. as part of one of your regular classes?

   ( ) No

   ( ) Yes. If yes, in which course? ____________

3. in a special library-use course?

   ( ) No

   ( ) Yes. If yes, what was the name of the course? ____________________. Name of the institution where taken: ________________________.

4. informally from a library staff member? ( ) No ( ) Yes

D. Have you ever worked in a library?

( ) No

( ) Yes. Was it: ( ) a high school library?
( ) a college or university library?
( ) a public library?
( ) other (specify): __________

What work did you perform? Please be specific (e.g., shelving, repairing books, circulation assistant, etc.): ____

How long have you worked in libraries? ________

APPENDIX B

FINAL SEARCH-PROBLEMS PRESENTED TO THE PARTICIPANTS

Known-Item Request

Does the library have, and if so what is the call number of the "Warren Report" submitted by the President's Commission on the Assassination of President John F. Kennedy?

- - - - - - - - - - - - - - - -

Does the library have, and if so what is the call number of, the book "The Structure of Science" by Ernest Nagel?

- - - - - - - - - - - - - - - -

Conventional Subject Requests

Locate the appropriate catalog cards that indicate the library contains material about the topic:

Chemistry as a profession

- - - - - - - - - - - - - - - -

Locate the appropriate catalog cards that indicate the library contains material about the topic:

Identification of firearms

- - - - - - - - - - - - - - - -

Locate the appropriate catalog cards that indicate the library contains material about the topic:

Statistical design

- - - - - - - - - - - - - - - -

Criticism Request

Assume you have the text of the title listed below, locate the appropriate catalog cards that indicate the library contains material about:

The tragedy by Friedrich Hebbel entitled "Agnes Bernauer"

APPENDIX B (contd.)

Individual-As-A-Subject Request

Locate the appropriate catalog cards that indicate the library contains material about (rather than by):

Otto Ludwig (a 19th Century writer)

- - - - - - - - - - - - - - -

Locate the appropriate catalog cards that indicate the library contains material about (rather than by):

Jackson Pollock

- - - - - - - - - - - - - - -

Locate the appropriate catalog cards that indicate the library contains material about (rather than by):

Honore Gabriel Riquetti (Count Mirabeau)

- - - - - - - - - - - - - - -

Corporate Entry-As-A-Subject Request

Locate the appropriate catalog cards that indicate the library contains material about (rather than by):

The Amateur Athletic Union of the U.S.

- - - - - - - - - - - - - - -

Locate the appropriate catalog cards that indicate the library contains material about (rather than by):

The Great Britain Board of Trade

- - - - - - - - - - - - - - - - -

Locate the appropriate catalog cards that indicate the library contains material about (rather than by):

The U.S. Civil Service Commission

APPENDIX C

FORMS USED FOR FINAL TEST GROUPS

LIBRARY RESEARCH CENTER
428 LIBRARY

27 January 1967

The Library Research Center of the University of Illinois is undertaking a study, supported by a federal grant, to determine how to make library catalogs more useful to university students. We have received permission to solicit the help of students at the University of Wisconsin and your name has appeared in a sample drawn from the student population.

Each participant will be requested to conduct a few short searches using the card catalog. The exercise will take less than one hour and will be conducted at the main catalog of the University's main library. In addition, you will be asked to complete a brief "information sheet." All information will be treated confidentially and at no time will the published results of this study identify specific individuals. Each student will receive payment of $1.50 for his participation in the study.

The success of any project such as this is dependent on the voluntary cooperation of participants. By the nature of the sampling method used, your participation is representative of approximately one hundred fifty of your fellow students. One of our objectives is to identify catalog-use habits of a wide variety of students, including those who have had little occasion to use the university library. May we express our sincere hope that you will find time to participate in this study.

Will you please complete the enclosed postcard reply and return no later than February 4, 1967? You will be contacted by the 8th to set up the exact time for the exercise. Every effort will be made to schedule you during the week of February 6-11, 1967.

Sincerely yours,

James Krikelas
Research Associate

JK/lc
encl.

APPENDIX C (contd.)

THIS SIDE OF CARD IS FOR ADDRESS

Professor John J. Boll
Library School of the
University of Wisconsin
425 Henry Mall
Madison, Wisconsin 53706

ATTN: James Krikelas

(PLEASE COMPLETE AND RETURN BY FEBRUARY 4, 1967)

Yes, I will participate in the catalog-use study being conducted.

My campus phone number is: ____________________

The best time to contact me is (give appropriate days and hours; e.g., Tuesday & Thursday, 4-6 p.m.):

____
Signature

APPENDIX C (contd.)

LIBRARY RESEARCH CENTER
428 LIBRARY

3 February 1967

The Library Research Center is undertaking a study, supported by a federal grant, to determine how to make library catalogs more useful to university students. We have received permission to solicit the help of students at the University of Illinois and your name has appeared in a sample drawn from the student population.

Each participant will be requested to complete a few short searches using the card catalog. The exercise will take less than one hour and will be conducted at the main catalog of the University's main library. In addition, we are enclosing an "information sheet" which is to be completed and returned prior to participating in the search exercise. All information will be treated confidentially and is intended only for the purpose of statistical analysis; at no time will the published results of this study identify specific individuals. Each student will receive payment of $1.50 for their participation in the study.

The success of any project such as this is dependent on the voluntary cooperation of participants. By the nature of the sampling method used, your participation is representative of approximately one hundred fifty of your fellow students. One of our objectives is to identify catalog-use habits of a wide variety of students including those who have had little occasion to use the university library. May we express our sincere hope that you will find time to participate in this study.

Will you please complete the enclosed "information sheet" and return it not later than February 15, 1967? You will be contacted by the 20th to set up the exact time for the exercise. Every effort will be made to schedule you during the week of February 20-25, 1967.

Sincerely yours,

James Krikelas
Research Associate

JK/lc
encl.

APPENDIX C (contd.)

LIBRARY RESEARCH CENTER
428 LIBRARY

GENERAL INFORMATION FORM
(Confidential)

A. PERSONAL AND EDUCATIONAL INFORMATION

1. Name (please print): ______________________________

2. Sex: ☐ Female ☐ Male 3. Age: __________

4. Class:

☐ Freshman
☐ Sophomore
☐ Junior
☐ Senior
☐ Graduate
☐ Professional Program
☐ Irregular (post-bachelor)
☐ Unclassified (non-degree)

5. NOT including the present semester (Feb. '67), how many semesters have you completed on this campus:

_____ Regular semesters _____ Summer sessions
(No.) (No.)

6. College enrolled in: ______________________________
(e.g.: Liberal Arts, Agriculture, Engineering, etc.)

7. Undergraduate major: ______________________________
(e.g.: Sociology, Physics, Civil Engineering, etc.)

8. Cumulative grade point average: __________

B. CATALOG USE

9. How frequently have you used the main public card catalog in the central library?

☐ Less than once a semester
☐ 1 or 2 times a semester
☐ 3 to 5 times a semester
☐ 6 to 10 times a semester
☐ 11 to 15 times a semester
☐ 16 or more times a semester

APPENDIX C (contd.)

B. CATALOG USE (continued)

10. How frequently have you used one or more of the *departmental* library catalogs?

    ☐ Less than once a semester
    ☐ 1 or 2 times a semester
    ☐ 3 to 5 times a semester
    ☐ 6 to 10 times a semester
    ☐ 11 to 15 times a semester
    ☐ 16 or more times a semester

11. In the use of *any* card catalog do you

    ☐ most frequently look for material by author or title?
    ☐ most frequently look for material by topic (subject)?
    ☐ use the subject approach about as often as the author-title approach?

C. LIBRARY EXPERIENCE

12. Have you ever received instruction in "how to use the library" in one or more of the following:

    a) as part of a general university orientation course?

    ☐ No ☐ Yes

    b) as part of one of your regular classes?

    ☐ No ☐ Yes

    c) in a special bibliography or library science course?

    ☐ No ☐ Yes

13. Have you ever worked in a library?

    ☐ No

    ☐ Yes. If yes, was it: ☐ a high school library?
    ☐ a college or university library?
    ☐ a public library?
    ☐ other (specify):

    ____

APPENDIX D

INVESTIGATOR'S INSTRUCTIONS TO EACH PARTICIPANT

The purpose of this study is to determine how, rather than why, you use the library's main catalog. To achieve this objective we have prepared a set of twelve problems which I am going to ask you to answer by using the main catalog only. Before explaining the procedure, I'd like you to complete this General Information Form. [AT ILLINOIS: request students to clarify any answer that is in question.] The information you give is to be used for general statistical analysis and at no time will you or your responses be identified by name.

The procedure will be to go to the catalog and to search for answers to each question. I am interested in two basic types of information. One is the procedure [search pattern] you use to seek the answers. The second, is your final decision about which cards are appropriate. In regard to this second point, you may arrive at one of two decisions: that there are no cards appropriate to the request in the main catalog; or, you may find one or more cards which are appropriate. If your decision is the latter, indicate exactly what you have located by showing me the card(s) and, at the same time, tell me in your own words what your decision is. Inasmuch as I will be observing your procedure it is not necessary to write your response on the cards (although you may if you wish) thus saving some time.

APPENDIX D (contd.)

The questions have been chosen randomly and it is conceivable that they represent requests about which you have no knowledge or interest. It is assumed, however, that your basic ability to use the catalog should allow you to reach some decision.

If you arrive at a point where you cannot think of anywhere else to look or when you would ordinarily seek help from the library staff, just indicate that to me, we'll consider that particular search at an end and you may proceed to the next problem.

ARE THERE ANY QUESTIONS? Let me caution you to read each problem carefully and to be sure in your mind that you understand what you are being asked for. Do not assume all requests are identical. You may begin.

APPENDIX E

CALCULATIONS FOR t-TEST FOR DIFFERENCE BETWEEN MEANS (MATCHED OBSERVATIONS)

Summary from data in Table 13:

$N = 31$

$\Sigma X_1 = 15.518$ $\qquad$ $\Sigma X_2 = 13.328$

$\overline{X}_1 = \dfrac{\Sigma X_1}{N} = \dfrac{15.518}{31} = .501$ $\qquad$ $\overline{X}_2 = \dfrac{\Sigma X_2}{N} = \dfrac{13.328}{31} = .430$

$\Sigma D = 2.190$ $\qquad$ $\Sigma D^2 = 1.820$

Standard error of the difference for matched groups:

$$\Sigma d^2 = \Sigma D^2 - \frac{(\Sigma D)^2}{N} = 1.820 - \frac{(2.190)^2}{31} = 1.665$$

$$s_d^2 = \frac{\Sigma d^2}{N-1} = \frac{1.665}{30} = .0555$$

$$s_d = \sqrt{s_d^2} = \sqrt{.0555} = 0.236$$

$$s_{\overline{x}_1-\overline{x}_2} = \frac{s_d}{\sqrt{N}} = \frac{.236}{\sqrt{31}} = 0.0423$$

t-Test for significance:

$$t = \frac{\overline{X}_1 - \overline{X}_2}{s_{\overline{x}_1-\overline{x}_2}} = \frac{.501 - .430}{.0423} = 1.678$$

APPENDIX F

STATISTICAL FORMULAE

[NOTE: The computation of the success ratio was carried out to three places after the decimal even if such mathematical precision was not significant. This was done to prevent misinterpretation due to rounding a number such as 0.996 to 1.0. In addition, some computations resulted in intervening zeros before the significant figure and would have required the presentation of data in an awkward and uneven manner (e.g., numbers of varying length such as 0.98, 0.031, 0.0056, etc.). The calculated success ratio and mean success scores were entered on machine-readable cards for computer processing. The computer output was recorded in eight digits and the appropriate decimal designation. These figures were also rounded to three digits after the decimal.

The various correlation coefficients (Pearson-r) reported in Chapter IV were done by computer. Other outputs were requested for the variables needed for each formulae and the corresponding statistic calculated by the investigator. These formulae are given in a form most convenient for computation and may represent slight variations from the formulae given in the sources cited in the text.]

Correlation Coefficient (Pearson-r)

Formula:

$$r = \frac{[\Sigma XY - \frac{\Sigma X \, \Sigma Y}{N}]}{\sqrt{[\Sigma X^2 - \frac{(\Sigma X)^2}{N}] \; [\Sigma Y^2 - \frac{(\Sigma Y)^2}{N}]}} \, .$$

Where: X = semesters in college, or semesters on campus, or grade point average;

Y = mean success score;

N = number of students for each group.

APPENDIX F (contd.)

Analysis of Variance

Formulae:

Sum of squares (total) = $SS_t = \Sigma X^2 - \frac{(\Sigma X)^2}{N}$.

Sum of squares (between) = SS_b

$$SS_b = \frac{(\Sigma X_1)^2}{n_1} + \frac{(\Sigma X_2)^2}{n_2} + \ldots + \frac{(\Sigma X_i)^2}{n_i} - \frac{(\Sigma X)^2}{N}.$$

Sum of squares (within) = $SS_w = SS_t - SS_b$.

Mean square = MS = SS/df; (df = degrees of freedom).

$F = MS_b/MS_w$.

Where: X = Mean success score;
N = Total number of students;
n_1, n_2, etc. = Number of students in each group.

Example of computer produced values:

Statistic	Semesters in College				Total
	1	3	5	7	
N	35	21	16	14	86
ΣX	13.849	8.918	6.576	6.682	36.025
ΣX^2	6.356	4.104	3.036	3.679	17.174
$\overline{X}$	.396	.425	.411	.477	.419

Example of calculation of F-statistic:

Source	SS	df	MS	F
Between	.068	3	.023	0.92
Within	2.016	82	.025	
Total	2.084	85		

APPENDIX F (contd.)

Point Biserial Correlation (r_{pb})

Formulae:

$$r_{pb} = \frac{n_t \Sigma Y_0 - n_0 \Sigma Y_t}{\sqrt{n_o n_1 [n_t \Sigma Y_t^2 - (\Sigma Y_t)^2]}}$$

$$t = \frac{r_{pb} \sqrt{N - 2}}{\sqrt{1 - (r_{pb})^2}}$$

Where: Y_0 = Mean success score for male students (or students with no instruction, or no work experience);

Y_1 = Mean success score for female students (or students with "some" instruction, or "some" work experience);

Y_t = Mean success score for all students;

n_0 = Number of "Y_0" students;

n_1 = Number of "Y_1" students;

n_t = Number of "Y_t" students.

Spearman-rho Rank Order Correlation (r_s)

Formulae:

$$r_s = \frac{6 \Sigma d^2}{N^3 - N}.$$

N = number of elements ranked.

APPENDIX F (contd.)

t-Test for Difference Between Means Without Pooled Variances

Formulae:

$$s_1^2 = \frac{\Sigma x^2 - \frac{(\Sigma x)^2}{n_1}}{n_1} \quad ; \quad s_2^2 = \frac{\Sigma x^2 - \frac{(\Sigma x)^2}{n_2}}{n_2} .$$

$$s_{\bar{x}_1 - \bar{x}_2} = \sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}$$

$$t = \frac{\bar{x}_1 - \bar{x}_2}{s_{\bar{x}_1 - \bar{x}_2}}$$

APPENDIX G

SUMMARY DATA

Student Identification[1] (1)	Sex (2)	Class[2] (3)	Semesters in College (4)	Semesters on Campus (5)	Frequency of Use of the Main Catalog[3] (6)	G.P.A. (7)	Approach[4] (8)	Instruction[5] (9)	Work Experience[5] (10)	8-Item Mean Success Score[6] (11)	9-Item Mean Success Score[6] (12)
005	1	1	1	1	2	4.6	2	0	1	.472	.532
006	2	4	7	3	2	3.7	1	0	1	.723	.754
007	2	3	5	1	3	3.5	2	0	0	.723	.643
008	2	4	7	7	2	3.3	1	0	0	.598	.532
009	2	2	3	3	1	3.2	2	0	0	.348	.309
010	1	1	1	1	2	3.5	2	1	0	.018	.016
011	1	3	5	1	2	3.5	3	1	0	.356	.316
012	2	2	3	3	1	3.1	1	0	0	.473	.420
013	2	3	5	1	2	3.0	2	1	0	.353	.313
014	2	1	1	1	1	3.2	1	0	1	.147	.131
015	1	1	1	1	1	3.1	1	1	0	.125	.111
016	2	2	3	3	4	3.1	1	1	0	.875	.889
017	2	4	8	8	1	3.3	1	0	0	.397	.353
018	2	3	5	5	2	3.6	1	0	0	.348	.310
019	1	1	1	1	4	4.8	3	1	0	.360	.320
020	1	3	5	5	6	4.1	3	0	0	.375	.333
021	1	3	5	3	4	3.8	3	1	0	.723	.643

APPENDIX G (contd.)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
022	1	3	5	5	1	3.3	3	0	0	.478	.425
023	1	3	5	3	2	4.1	1	0	0	.598	.532
025	1	1	1	1	1	4.8	1	1	0	.473	.420
026	1	1	1	1	2	3.1	1	0	1	.556	.495
027	1	3	5	1	2	3.4	3	0	0	.223	.198
029	2	3	5	1	1	3.9	1	0	0	.473	.420
030	2	4	7	7	4	4.9	3	0	0	.728	.647
031	2	4	7	7	6	3.8	3	1	0	.598	.643
032	1	1	1	1	1	3.8	3	0	0	.598	.532
034	1	1	1	1	1	3.9	3	0	0	.125	.111
035	2	3	5	5	1	3.6	1	0	0	.723	.035
036	1	1	1	1	1	3.6	3	1	0	.371	.330
037	2	4	7	7	1	3.6	1	1	0	.603	.536
038	2	3	5	5	3	3.6	2	0	0	.348	.313
039	1	4	7	6	4	3.1	2	1	0	.996	.885
041	1	3	5	5	4	4.0	1	0	0	.130	.115
042	1	1	1	1	1	3.7	1	0	1	.598	.532
044	1	1	1	1	3	3.3	3	0	1	.125	.111
045	1	1	1	1	2	3.6	1	1	0	.598	.532
046	2	3	4	4	4	3.8	1	0	0	.125	.111
047	1	2	3	1	4	4.6	2	1	1	.683	.718
048	2	1	1	1	1	3.6	2	0	0	.723	.643
049	1	3	5	1	2	3.3	3	0	0	.496	.441
050	1	4	7	7	5	3.0	2	0	0	.223	.198
052	2	3	5	1	1	3.0	2	1	0	.000	.000

APPENDIX G (contd.)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
053	2	4	9	9	3	3.5	1	1	0	.542	.482
054	2	3	5	6	6	3.3	3	0	0	.848	.865
055	2	1	1	1	1	2.0	3	0	0	.250	.222
056	1	1	2	3	1	3.7	1	0	1	.598	.532
057	1	3	5	5	1	3.4	1	0	0	.746	.663
058	1	3	5	1	3	4.2	1	1	0	.000	.000
059	2	2	3	2	1	3.9	1	0	0	.638	.567
060	2	4	7	7	1	3.5	1	0	0	.228	.202
451	1	2	1	1	3	4.7	3	0	0	.612	.550
453	1	1	1	1	3	3.9	2	1	0	.651	.579
455	2	2	3	3	2	3.6	2	0	0	.389	.346
456	1	2	3	3	2	3.7	1	0	0	.435	.401
457	2	1	1	1	1	3.7	2	0	0	.442	.419
458	2	1	1	1	1	4.6	3	0	0	.478	.425
459	1	4	7	7	4	3.4	1	0	0	.250	.222
460	1	4	7	3	3	4.2	3	0	0	.346	.313
461	2	2	3	3	2	3.9	3	0	0	.298	.315
462	2	1	1	1	1	2.5	3	1	0	.267	.238
463	2	3	5	5	3	4.3	2	0	0	.192	.171
465	1	1	1	1	6	4.4	2	1	1	.725	.644
466	1	2	3	3	2	4.0	2	1	0	.401	.356
467	2	1	1	1	2	4.6	2	0	0	.234	.208
468	1	2	3	3	4	4.6	2	0	0	.755	.719
469	1	2	3	1	1	3.9	3	0	0	.442	.393
471	2	4	7	7	4	4.5	2	0	0	.580	.516

APPENDIX G (contd.)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
472	1	2	3	3	3	3.3	3	0	1	.434	.386
473	2	2	3	3	4	3.3	2	1	0	.667	.593
474	2	2	3	3	3	3.1	1	0	0	.281	.250
475	1	1	1	1	5	3.8	2	0	0	.548	.537
476	2	3	5	2	2	3.6	1	1	0	.381	.339
477	2	3	5	5	3	3.2	3	0	0	.899	.799
478	2	2	3	3	1	3.1	2	0	0	.453	.403
479	2	1	1	1	3	3.9	1	1	0	.342	.329
480	1	3	5	3	2	3.2	3	0	0	.466	.414
482	1	4	7	7	1	4.5	3	0	0	.856	.872
483	1	3	5	5	5	3.3	2	0	0	.347	.364
484	1	4	7	7	2	3.6	1	0	0	.213	.190
485	2	3	5	5	3	3.4	3	0	0	.483	.410
486	1	2	3	3	4	3.6	2	1	0	.417	.370
487	2	1	1	1	1	3.0	1	0	0	.315	.280
488	1	2	3	3	1	2.8	2	0	0	.266	.237
489	1	1	1	1	3	4.0	3	0	0	.429	.381
490	1	1	1	1	3	3.0	1	1	1	.362	.321
491	2	3	5	2	3	3.7	2	0	0	.430	.382
493	1	3	5	1	3	4.2	1	1	0	.529	.470
494	2	2	3	3	3	3.6	2	0	0	.481	.428
495	1	4	7	7	1	3.4	3	0	0	.371	.330
497	2	4	9	5	1	3.0	2	0	0	.347	.308
498	1	3	5	3	4	3.6	2	0	0	.347	.308
499	2	4	7	7	3	4.0	1	0	0	.661	.588

APPENDIX G (contd.)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
500	2	2	3	3	2	3.7	2	1	0	.396	.352
501	1	3	5	1	1	3.5	3	1	0	.478	.425
502	1	1	1	1	4	4.5	2	1	1	.772	.734
503	1	3	5	4	2	4.0	1	0	0	.742	.660
504	1	1	1	1	1	2.1	2	0	0	.467	.492
505	1	4	6	6	4	3.4	1	1	0	.474	.421
507	2	1	1	1	3	3.8	3	0	0	.381	.339
508	2	1	1	1	3	3.5	3	0	0	.401	.356
509	2	4	9	9	1	4.2	1	1	0	.481	.515
510	2	3	5	1	2	4.0	1	0	0	.294	.266
512	2	4	7	2	2	3.8	2	0	0	.625	.451
513	2	4	7	7	2	3.0	2	1	0	.500	.444
514	2	1	1	1	1	4.3	1	0	0	.514	.453
515	2	4	7	7	2	3.8	2	0	1	.544	.515
516	2	1	1	1	1	3.5	3	0	0	.314	.279
518	2	1	1	1	3	3.1	2	1	0	.472	.424
519	1	2	3	3	1	3.8	1	1	1	.450	.400
520	2	2	3	3	2	3.2	3	0	0	.442	.392
521	2	3	5	5	3	3.7	1	0	0	.325	.293
523	2	3	5	5	1	3.3	1	1	0	.621	.552
524	2	1	1	1	6	4.5	3	1	0	.305	.271
525	2	4	7	5	4	4.7	2	0	0	.353	.314
526	1	1	1	1	2	3.7	2	0	0	.480	.426
527	2	1	1	1	1	4.3	3	0	0	.578	.514
528	2	1	1	1	1	3.7	3	1	0	.339	.307

APPENDIX G (contd.)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
529	2	4	7	7	2	4.5	3	0	0	.562	.524
530	2	2	3	3	1	3.9	2	0	0	.703	.625
531	1	3	5	5	5	3.9	1	0	0	.480	.426
532	2	1	1	1	2	2.3	2	0	1	.111	.098
533	1	1	1	1	3	4.2	3	1	0	.352	.313
534	2	3	5	3	1	3.4	1	1	0	.394	.350
535	2	2	3	3	3	3.7	2	0	0	.625	.578
538	2	1	1	1	3	2.6	1	0	0	.722	.753
541	2	4	7	5	2	4.4	3	0	1	.722	.578
542	2	2	3	3	2	4.5	1	0	0	.400	.355
543	2	1	1	1	3	2.7	2	1	1	.685	.609
544	1	1	1	1	3	4.4	3	0	1	.452	.402
545	2	3	5	1	2	4.2	3	1	1	.700	.622
546	2	1	1	1	1	3.5	1	0	0	.343	.305
547	2	1	1	1	1	3.1	1	0	0	.172	.153
548	2	1	1	1	1	3.9	2	0	0	.338	.301
549	2	1	1	1	1	3.1	3	0	0	.392	.349
550	1	1	1	1	3	5.0	2	1	1	.500	.556
552	2	1	1	1	1	3.8	3	0	0	.469	.417
553	1	4	6	2	2	3.5	1	0	0	.990	.980
555	2	4	7	7	1	3.4	1	0	0	.619	.550
556	1	1	1	1	5	2.5	2	1	1	.098	.087
557	2	4	7	7	1	3.5	2	0	1	.728	.758
558	2	3	5	5	4	3.7	3	0	0	.484	.541
560	2	2	3	3	3	4.3	2	1	0	.467	.415

APPENDIX G (contd.)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
564	1	2	3	3	4	3.2	3	0	0	.680	.604
567	1	3	5	5	3	3.5	2	0	0	.298	.265

[1] Numbers 005 through 060 were assigned to Wisconsin participants; numbers 451 through 567 designate Illinois participants.

[2] Class has been coded as follows: 1 = Freshmen, 2 = Sophomores, 3 = Juniors, and 4 = Seniors.

[3] For "Frequency of Use of the Main Catalog" see code as given in Table 8 (p. 56).

[4] Approach has been coded as follows: 1 = most frequently look for material by author or title, 2 = most frequently look for material by topic (subject), and 3 = use the subject approach about as often as the author-title approach.

[5] For Instruction and Work Experience, 0 = "none" and 1 = "some."

[6] Mean success scores were computed for eight searches for comparison between schools; nine searches were used to computed the mean success score for all other statistical analyses (within schools).

VITA

James Krikelas was born in Cudahy, Wisconsin on December 17, 1932. After completing two years at the University of Wisconsin he entered the U.S. Army. He returned to the University and received his B.S. in 1958 and his M.S. in Library Science from that institution in 1959. While a graduate student he worked as an assistant in the Math-Physics library.

From 1959 to 1963, he served as technical services librarian and later as head librarian of Milwaukee-Downer College. In addition to his library duties he taught a course in cataloging. He has also served as a visiting instructor at the University of Wisconsin--Milwaukee.

In September, 1963 he enrolled in the doctoral program in library science at the University of Illinois. He was employed, successively, as a graduate assistant and instructor in the Graduate School of Library Science and as a Research Associate in the Library Research Center, University of Illinois.

He is married to Joan Gottfried Krikelas and has two sons, Andrew and Paul.

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The Effect of Arrangement on the Use of Library Catalogs: An Experimental Study of a Divided and a Dictionary Catalog. (Final Report)

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RETRIEVAL TERMS

Library Catalogs
Catalogs, Card
Catalogs, Dictionary
Catalogs, Subject
Catalog Use Studies

IDENTIFIERS

Comparative Analysis

ABSTRACT

The purpose of this study was to determine if dividing a traditional dictionary catalog to create a separate file for subject entries would result in an increase in the effective use of library catalogs. The study was developed in terms of the variables pertinent to a catalog search--the question, the catalog and the user.

A set of search-questions was developed as the data collection instrument. Two catalogs--one in dictionary arrangement, the other divided into subject and non-subject entries--were selected and the appropriate sections verified in regard to similarity of size and complexity. Participants were selected randomly from the undergraduate population of ~~the~~ two universities. Students were paired by matching on a number of criteria which measured familiarity and exposure to the catalog (each pair constituting a single patron).

Effective use of the catalog was measured in terms of a mean success score. This score represented the ability of participants to select appropriate subject references (cards) in response to the questions. This measure credited the searcher for locating pertinent references and penalizing him for including inappropriate references.

As a result of this study, it was concluded that for a series of questions representing different levels of difficulty and for a fairly limited range of catalog use habits and ability, changes in the arrangement of large catalogs would not result in more effective use. At the same time, there was no evidence to indicate that one type of catalog was superior to the other.

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